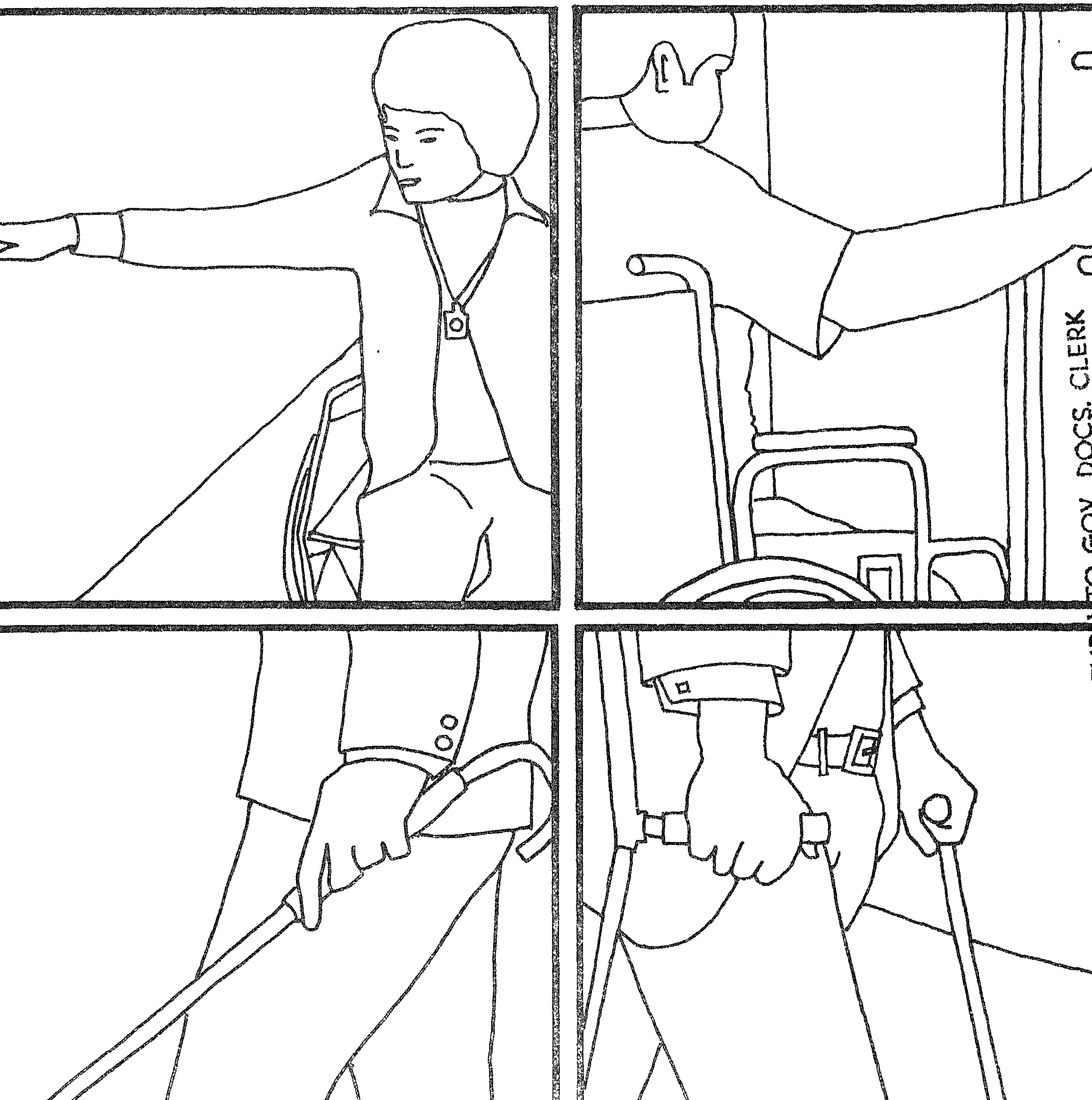
ccess to the Built Environment: Review of Literature



Access to the Built Environment: A Review of Literature

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FOREWORD

Over the last decades, Americans have been learning to see what we have never seen before. I refer not to flying saucers but to people -- people who have been hidden from us by prejudice, by custom, and by ignorance. Ralph Ellison described the phenomenon for blacks in his powerful novel, The Invisible Man.

Today, finally, we see the black population; we are only beginning to see other groups -- women, the American Indian, the elderly, the handicapped -- see them both as national resources and as groups having claims on the national conscience.

This publication is one of a series of six, the titles of which are listed in the acknowledgements, that HUD's Office of Policy Development and Research has sponsored to accomplish the important task of making buildings accessible to and usable by the physically handicapped through improving the American National Standards Institute's A117 standard.

Prepared under the supervision of the Office of Policy Development and Research, these volumes have won a research award from Progressive Architecture. To quote from the jury comments: "In terms of the effect that the work will have on future architecture and planning, the new ANSI standard A117.7 has got to be the blockbuster of all.....It's a very solid piece of work."

It is indeed. I am proud to present it to you.

Donna E. Shalala
Assistant Secretary
for Policy Development
and Research

Acknowledgements

We wish to thank the many people who contributed to the research and d velopment of this report. In particular, Charles Gueli and Deborah Greenstein, Office of Policy Development and Research, HUD, who provided advice and assistance through their efforts as Government Techni Representatives for the contract. Finally, Jean Caraccilo, as the off secretary, provided immeasurable assistance through typing and day-to- logistical support.

This report is one of a series of reports prepared under this contract The full series includes:

1. Access to the Built Environment: A Review of Literature
2. Accessible Buildings for People with Walking and Reaching Limitations
3. Accessible Buildings for People with Severe Visual Impairments
4. The Estimated Cost of Accessible Buildings
5. A Cost-Benefit Analysis of Accessibility
6. Adaptable Dwellings

All of this research contributed to the development of the proposed re visions to ANSI A117.1, Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped.

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ntroduction, Executive Summary

Introduction and Executive Summary

This report is a product of a three-year research contract entitled, "A New ANSI Standard for the Physically Handicapped". The purpose of the project was to identify the necessary revisions and additions to improve the existing American National Standards Institute's ANSI A117.1 Standard, "Making Buildings Accessible and Usable by the Physically Handicapped".

This report presents the current state of the art in knowledge regarding barrier-free design or the process of making the built environment accessible to people with disabilties. Specifically, the report describes:

1. The history and trends in efforts to achieve a barrier-free environment.
2. The extent of the problem, i.e. who it effects.
3. Existing federal, state and municipal legislation and regulations regarding barrier-free design.
4. The identification of the scope of barrier-free design problems.
5. Research findings that could be applied to the design of barrier-free environments.
6. Knowledge about the effects of barriers on the life patterns of people and how those effects could be mitigated.

Building on this initial data and knowledge base, the project then focused on:

1. Identifying particularly difficult design problems and solutions to them.
2. Laboratory testing to resolve conflicts and inadequacies in existing design criteria.
3. The development of proposed standards with the participation of consumers, designers, the building industry and regulatory agencies.
4. A study of the cost of building accessible buildings.
5. An analysis of economic costs and benefits.

Below are summaries of the major findings and positions of this report.

1. Access as a Civil Right

The civil rights of disabled people are slowly but surely being guaranteed through legislation and court action. Although people with disabilitie are not yet included in civil rights legislation, there is a trend in other legislation to mandate guarantees against discrimination similar to those that racial minorities, women and the aged have received regarding employment, use of places of public accommodation, housing, etc. The right of access to the built environment is firmly established in existing civil rights legislation, although it is not specifically directed

segregated from full participation in normal community life.

The above paragraph summarizes the main theme of the paper, "Access as a Civil Right". The following is an outline of the contents of this section:

1. Brief history of barrier-free design movement;
2. Legislation specifically regarding barrier-free design:
   PL 98-333 Vocational Rehabilitation Act of 1964
   PL 90-480 Architectural Barrier Act of 1968
   PL 91-205 Amendment to PL 90-480
   PL 93-112 Rehabilitation Act of 1973
   PL 93-518 Rehabilitation Act Amendments of 1974
3. Legislation regarding civil rights or minorities:
   PL 85-315 Civil Rights Act of 1957
   PL 88-352 Civil Rights Act of 1964
   PL 92-496 Act to Extend Life of Civil Rights Commission Equal Rights Amendment of 1972
4. Parallels drawn between the physically disabled, minority groups and other groups disadvantaged in civil rights, e.g. women and the aged;
5. Normalization approaches taken by Denmark, Sweden and Holland;
6. Conclusion and predictions for future concepts of barrier-free design as a civil right of the handicapped.

2. The Disabled Population

There are several alternative definitions of disability. Each can be used to generate estimates of the people in the U.S. population who can be expected to benefit from the removal of environmental barriers. Using the definition that is most conservative -- needing help for mobility and/or personal care and being severely disabled -- results in an estimate of 1.7 to 2.2 percent of the noninstitutionalized population. Using a definition that is moderate -- needing help for mobility and/or personal care -- results in an estimate of 5.3 percent of the U.S. population. Using the most liberal definition -- limited in ability to do any usual everyday activity -- results in an estimate of over 11.6 percent of the population. The first two estimates exclude many who would probably benefit to a limited extent from removal of environmental barriers even though their disabilities are not very severe. All estimates may include a small amount of people who will not benefit at all because their disabilties are too severe and exclude those in institutions who may benefit from increased opportunity to live independently. Estimates based on the major sources of data vary due to differences in the definitions used to define disability and the items on which data is collected.

The impact of removing barriers from specific parts of the physical environment, e.g. doors and stairs, can be measured by determining how

many people have limitations of action that result in problems in usi
them. There is no comprehensive data base for statistics on limitati
of physical activities although some data can be pieced together from
available sources.

Estimates of the number of people expected to benefit from removal of
environmental barriers in a building or facility cannot be based sole
on the proportion of disabled people in the U.S. population. Interre
demographic factors and actual behavior must be considered. Since di
ability is highly related to age, a longitudinal point of view is des
able. That is, the fact that a great many people who are not disable
today will become disabled when they get older means that, any action
taken to remove environmental barriers in a building or facility used
older people will benefit a lot more people than only those who are n
disabled. The prevalence of disability is related to geographic loca-
tion. Thus, the expected beneficiary population will differ, based o
the location of a particular building or facility. The influence of
cation is highly variable and is based on regional and state location
well as location with respect to a major city. Finally, there is evi-
dence to indicate that, for some community based activities, particip
tion decreases with the onset of a disability. Thus, the expected ra
of utilization of a building or facility by people with disabilities
be considered in estimating the size of the population who will benef

3. <u>Accessibility Codes and Regulations</u>

A review of all state and federal legislation and standards addressed
barrier-free design, all model building codes, several municipal code
and some international standards discovered that:

1. The original ANSI A117.1 Standard has been either adopted or used as a model by all 50 states.
2. Many states have deleted sections of ANSI A117.1, others have added to it.
3. Model codes have differed from ANSI A117.1 in some important areas.
4. Standards issued as regulations of federal agencies have used ANSI A117.1 as a model with some agencies making many changes to it.
5. The variances from ANSI A117.1 made by states, model codes and agencies generally apply to areas that were inadequately treated or to the form of the requirements; there has been a trend toward prescriptive rather than qualitative specifications.
6. There is a lack of uniformity and proliferation of local, regional and agency differences in design criteria for accessibility.
7. There has not been a conclusive, explicit policy regarding the target user population for standards.
8. Ambiguous wording in standards is a continuing problem

10. There is an inadequate base of information regarding the use and design of building products.
11. Codes and other regulations have not been fully implemented and enforced.

Recent efforts by state governments and the Federal Government have sought to resolve some of the problems associated with design standards. Many states have extended the scope of barrier-free legislations to include privately funded, publicly used buildings and facilities.

4. The Scope of Barrier-Free Design

The Enabler was conceived as an ideogram that represents the many disabilities to be considered in designing a barrier-free environment. These disabilities include:

- Difficulty interpreting information
- Severe loss of sight
- Complete loss of sight
- Prevalence of poor balance
- Incoordination
- Limitations of stamina
- Difficulty moving head
- Difficulty reaching with arms
- Difficulty handling and fingering
- Loss of upper extremity skills
- Difficulty bending, kneeling, etc.
- Reliance on walking aids
- Inability to use lower extremities
- Extremes of size and weight

Matrices were prepared that identified, in graphic form, the problems people with each of these disabilities have in using the environment.

5. Human Factors Research

Human factors research has focused on the fit between human performance and physical environment. A review of this knowledge area produced a unifying concept for barrier-free design -- buildings conceived as task environments for access. This conception puts accessibility concerns into an integrated framework of human performance. It allowed the generation of an exhaustive list of information needs for design. Empirical research findings were reviewed to identify how these information needs are presently being met. Methodological limitations of human factors research have also been noted. The review highlighted many areas in human factors work on other task environments that provide knowledge and principles directly transferrable to designing buildings for access.

Human factors research on functional anthropometry, biomechanics, in-

design. From this review, the following broad conclusions can be drawn:

1. Functional Anthropometry
   - A. the principles of applying anthropometric data to design are well established,
   - B. there is a need for better data on disabled populations,
   - C. the most useful kinds of data to obtain would be dynamic and situation-based.
2. Biomechanics
   - A. there is a need for comprehensive presentation of information on range of movement for disabled people,
   - B. basic principles for considering range of movement and accuracy in design are available,
   - C. general principles for considering speed of performance are well established,
   - D. there is a need for data on strength in situations typical of building use,
   - E. there is a need for general data on strength of disabled and elderly populations,
   - F. some data on endurance and comfort is available, yet there is a complete lack of data for some important design concerns regarding disabled and elderly people.
3. Information Display
   - A. principles of coding and organization of information are well established,
   - B. there is a great deal of general design data available, much of which can be applied to disabled and elderly users,
   - C. there is a lack of information on tactile warning signals,
   - D. information is needed about the perceptual process of people with sensory impairments.
4. Specific Task Environments
   - A. research on specific task environments can provide important data on relationships between elements in a setting,
   - B. empirical research on specific environments using disabled subjects is conflicting,
   - C. there is a lack of research in bathroom design for disabled people.
5. Research Methods
   - A. research methods in human factors analysis should strive to simulate field conditions more closely,
   - B. methods with less reactivity and bias should be developed,
   - C. subject selection and description and treatment of data should strive to improve generalizability by proper generalization from sample populations.

design information pertaining to access. There are also some important information gaps.

6. Impact of Accessibility

The built environment communicates to those who use it. It speaks a kind of "silent language" (Hall, 1959) that transmits messages about appropriate behavior and meanings. These messages also can have an affective component that reflects back to the user. Individuals who, because of disabilities, are illiterate in the language of environment, or who interpret messages through a physiological screen, may not receive important information or may interpret messages differently than the non-disabled. Illiteracy and interpretation problems can result in inappropriate behavior, confusion, or negative feelings of selfworth.

The way one organizes space as a mental image is based on how one experiences it. Although further research is needed in environmental cognition, it appears that people with disabilities may image space differently than ablebodied people, since they have different kinds of experiences. Differences in experience lead to differences in the valued parts of the environment and systems of orientation.

Territorial behavior is closely associated with social dominance. Exclusion through environmental barriers can be viewed as a form of territorial behavior whereby the ablebodied claim the best space. The disabled act out their low position in the dominance hierarchy by being forced to occupy stigmatized, institutional space.

The development of competence-building settings can aid the adaptive capacity of disabled people. We view the relationship between these two as a set of interlocking careers; the adaptation career of the individual and the adaptation career of the environment. They are interlocked because if the environment is modified to meet the needs of a person then one has in effect increased his competence and, therefore, made him adapt to the circumstances. Environments must be designed so that they can adapt to match the physiological career of the individual.

Although we can identify several discrete psycho-social implications of inaccessibility, they do not act independently to effect a person's behavior. The entire social and physical world impacts on a person. Individual forces in that life space cannot be added together as simple sums, rather, the forces in the life space work as a whole and as a function of the individual as well. For example, all disabled people probably do not experience the negative effects of territorial exclusion as social dominance. Moreover, attitudes and action of other people that send positive messages to the disabled person may counteract negative messages from an inaccessible building.

It is important to remember that a society may act supportingly in many ways through interpersonal actions of its members but the society's

actions in shaping the physical environment may be unsupportive -- not because of their attitudes, but because of traditional ways of building and lack of knowing any people, without corresponding change the built environment, a truly responsive life space will not exist.

The task which faces us is to design truly responsive environments wh all people have opportunities to develop competence. As we have seen one cannot speak of competence as being a quality which lies exclusiv within individuals. Rather, it is a relationship between oneself anc the object that one is attempting to manipulate. Environments are co structed to meet the physiological norms of normal people, to allow t average person to display an average amount of environmental competen If the design of the environment gets out of line with the physiologi norms of people then they of course become less competent. The term applied to an environment where such a discrepancy exists is nonfunct i.e. one cannot function (be competent) within it. When such a condi exists, the blame for the misfit is placed upon the environment and i is subsequently changed. Since the disabled person has different phy logical norms it is only natural that his relationship to the environ is different from that of the able bodied.

7. Changing Attitudes through Design

Environmental modification will not eliminate the stigma of disabilit It will, however, decrease that stigma to the degree that it increase person's environmental competence. We, therefore, have it in our har to substantially increase the quality of life of a section of society that has needlessly sufferred for too long. It is of course extremel difficult to change the minds of people. One cannot simply legislate away stigma because such stigma arises out of interaction between pec We can, however, legislate the design of the physical environment anc changing the conditions under which people interact eventually change very quality of that interaction. Hopefully, this will bring closer day when a person with a crutch is no longer considered first and for a "cripple" but someone who is essentially a human being with the goc and bad qualities that make up that identity.

2

Access as a Civil Right

Introduction

What would we feel if we were told that there was a group of Americans who because of their national origin were to be denied the rights of other Americans? These people from country X were discouraged from using public space unless they were accompanied by an American of some other national origin. The X group did not go out in public much because other Americans were too busy to accompany them, as they had jobs to go to. The X group, however, had lots of time on their hands because most of them were not allowed to hold jobs. As a consequence the X people were made to spend nearly all their time in homes that were built in such a way that they could not use them no matter how hard they tried. The government, realizing that the X people were not allowed to hold jobs, felt sorry for them and gave them a little money every month so that they would not starve as they sat in their homes which they could not use.

Our first reaction to this story is that it is absurd. No group, not even blacks during the height of segregation policies, was treated this badly. Yet today a large number of Americans are treated in the way we have described--they are people with disabilities. Most Americans do not know that people with disabilities are objects of discrimination through the construction of the environment. Furthermore, when such discrimination is pointed out, many refuse to acknowledge it as a violation of rights. The disabled person, they claim, has forfeited his right to equal access due to his disability.

It is not consistent with our national ideals that a person with a disability should be denied his civil rights. Currently, due to the efforts of representatives of various disabled groups and others, progress is being made toward redressing these wrongs.

This section will first discuss the history of the civil rights movement for the people with disabilities, then turn to the major issues: access as a civil right; integration versus segregation in housing and transportation; and, the question of normalization. Finally, this chapter indicates the direction of future effort: toward a total integration of the disabled and the nondisabled in a barrier-free environment.

The initial literature review for this study consisted of a computerized literature search using ERIC and MEDLARS, two computer abstracting services. This produced very little material. The most fruitful source of citation was the "Monthly Catalogue of United States Government Publications." Syracuse University is a depository library for government documents, and most of the citations were, therefore, available on micro-fiche.

<u>The Congressional Record</u>, <u>United States Statutes At Large</u>, the <u>Congressional and Administrative News</u> and the <u>Congressional Information Services Index</u> were the major sources of information for the

Various documents from organizations involved in the barrier-free design movement were reviewed to provide an overview of past history, current trends and future possibilities.

History of Architectural Barriers Movement

The origins of the movement to eliminate architectural barriers date back to the 1950s. Ironically in 1957, Hugh Deffener, a proponent of barrier-free design, had to be carried up a flight of stairs to receive the Handicapped American of the Year Award. Two years later the barrier-free design movement was in full swing.

A document entitled Tentative Guide - Facilities in Public Buildings for Persons with Ambulatory Impairments was published by Dr. Dwight York and other Veterans Administration staff members, in conjunction with the Ad Hoc Committee on Building Entrances, a subcommittee of the President's Committee on Employment of the Physically Handicapped. As a result of this document, the Public Building Administration issued a directive to its field offices throughout the country which stated: "All new federal buildings shall provide easy access of wheelchairs to the first floor entrance lobby. Where entrance steps are unavoidable, ramps and handrails must be provided" (President's Committee on Employment, 1959).

During this period, the National Easter Seal Society joined with the President's Committee to launch a major drive against architectural barriers. A research grant was awarded to the University of Illinois to develop permanent standards which would make public buildings accessible to people with physical disabilities.

In 1961 the American Standards Association, now known as the American National Standards Institute, in cooperation with the National Easter Seal Society for Crippled Children and Adults, the University of Illinois and the President's Committee, published standards, "Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped," intended to provide access to persons with ambulatory difficulties (President's Committee, 1961). With the publication of these standards, a national education drive was undertaken to ensure adoption of these standards by state bodies.

Due to the efforts of various public and private agencies, by 1965 twenty-four states had taken some type of action towards implementing the standards through legislation or adoption into local building codes (Architectural and Transportation Barriers Compliance Board, 1974). Unfortunately, much of this effort was frustrated by the fact that the legislation was not comprehensive enough and the fact that no sanctions were built into the legislation to ensure compliance. This problem was documented years later by a study conducted by the federal government. Thus, only symbolic progress had been made since 1959 at the state and local levels.

federal legislation to further the barrier-free design movement was Public Law 89-333, Vocational Rehabilitation Amendment Act of 1965. Section 15 of this Act authorized the formulation of a National Commission on Architectural Barriers. This commission grew out of the desire of Congress to discover what had been achieved in regard to elimination of architectural barriers. The duties of the Commisssion were as follows:

1. Determine how and to what extent architectural barriers impede access to or use of facilities in buildings of all types by the handicapped,

2. Determine what is being done, expecially by public and other nonprofit agencies and groups having an interest in and a capacity to deal with the problem, to eliminate such barriers from existing buildings and to prevent their incorporation into buildings constructed in the future, and

3. Prepare plans and proposals for such further action as may be necessary to achieve the goal of ready access and full use of facilities in buildings of all types by the handicapped, including proposals for bringing together, in a cooperative effort, agencies, organizations and groups already working toward that goal, or whose cooperation is essential to effective and comprehensive action (U. S. Statutes, 1965).

This commission studied the issues for two years and in 1967 issued its report, Design for All Americans (1968). The findings of the study were as follows:

1. Architects were unaware of the problem. The National League of Cities surveyed 2,975 architects; out of the 709 architects who replied, only 251 had any awareness of the ANSI 117.1 Standards, Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped.

2. Manufacturers and suppliers of building materials were unaware of standards. Out of seven major national trade organizations, none had established any policies about meeting the standards and only three were familiar with them.

3. None of the four major building codes made any reference to architectural barriers.

4. A lack of public interest was the prime reason public officials gave for failure to develop public programs around this issue.

and concerned citizenry, change was not achieved by voluntary efforts.

6. Although lack of usable transportation by the aged and handicapped was the most serious problem, it had received almost no attention; there were no standard specifications that apply to it.

7. The ANSI Standards did not cover residential structures or transportation systems. They did not spell out in just what facilities and to what extent the specifications should be followed.

As a result of these findings, the following recommendations were made:

1. Enactment of federal legislation that required all new buildings and facilities intended for public use must be designed to accommodate the elderly and the handicapped if any federal funds are used in their construction.

2. Issuance of an executive order that applied accessibility standards to new construction and that directed all federal agencies to plan and budget for feasible changes in their existing buildings and facilities.

3. Enactment or revision of state legislation that required state and local buildings, constructed with public funds, meet accessibility standards, that included strong enforcement provisions.

4. Revision of all building codes so that industries, shops and other privately owned structures used by the public would be built for accessibility in the future and so that renovation of existing buildings would bring feasible improvements in accessibility.

5. Assignment of responsibility and resources to specific units of federal, state and local governments, so that they would administer the accessibility legislation, would conduct and/or support research and demonstrations, and would work with voluntary, professional, business and industrial organizations to the end that all buildings and facilities would be readily accessible to elderly and handicapped individuals.

6. Expansion of public and privately supported information

90-480 was passed and implemented many of the recommendations of the Commission. This act, known as the Architectural Barrier Act of 1968 was to "ensure that certain public buildings, financed with federal funds, are so designed and constructed as to be accessible to the physically handicapped" (U. S. Statutes, 1968).

Under this law, all new construction of government facilities and renovations of existing facilities were to be designed and constructed so as to be accessible. The Director of General Services Administration, the Secretary of Housing and Urban Development, and the Secretary of Defense were authorized to prescribe standards for compliance. The existing ANSI 117.1 Standard from 1961 was chosen as a model to follow. This now brought the federal government up to the level of legislative activity already reached by some thirty-four states.

One major recommendation of the commission of 1967 on standards for transportation systems was not implemented. This fact was realized at the beginning of construction of the multibillion dollar District of Columbia transit system. It was concluded by the lawyers of the General Services Administration that PL 90-480 did not require this transportation system to be designed to include access for people with disabilities. Thus, legislation was introduced on October 22, 1969, known as PL 91-205, which amended PL 90-480 (U. S. Statutes, 1970-71). This legislation broadened the interpretation of PL 90-480 to include public transportation such as busses, railways, cars, trains or similar types of rolling stock constructed by the authority of the National Capital Transportation Act of 1960, the National Capital Transportation Act of 1965 and Title III of the Washington Metropolitan Transit Regulation Compact.

Just as Design for All Americans had pointed out the need for sanctions in the legislation, another study done in Iowa, (Accessibility-the Law and the Reality, 1974) again documented spotty compliance with the laws, and noted that there was no control unit in the federal government to ensure compliance. In 1975, the Government Accounting Office (GAO) issued a report with further evidence of poor compliance (GAO, 1975).

In 1973 major legislation was passed which specifically dealt with the problem of compliance. Section 502 of the Rehabilitation Act of 1973, PL 93-112, which created the Architectural and Transportation Barrier Compliance Board within the federal government, was passed on September 26, 1973. This board was composed of the heads of the Departments of Health, Education and Welfare, Transportation, Housing and Urban Development, Labor, Interior, General Services Administration, United States Postal Service and the Veterans Administration. The major function of this board is to ensure compliance with the standards prescribed by the General Services Administration, the Department of Defense and the Department of Housing and Urban Development, pursuant to the Architectural Barrier Act of 1968 (PL 90-480), as amended by the Act of March 5, 1970 (PL 91-205).

progress has been legislative without effective compliance mechanisms and actions. Thousands of barriers are still being constructed daily and little is done to stop this (GAO, 1975).

Access as a Civil Right

Despite the legislative progress, there is one central theme permeating all access literature since 1959 that has still not been formalized in federal legislation. That concept, although not often stated in these terms, is the civil right of access: the right of disabled people to enjoy the same rights to life, liberty and the pursuit of happiness guaranteed by our Bill of Rights.

Through the recognition of civil rights as an issue in our society, the concept of protection from discrimination by race has been broadened to include protection from discrimination by sex and age. Through legislation and court cases, the right to employment, education and free movement is being slowly guaranteed to varied population segments, although civil rights enforcement is usually considered only in terms of race.

On September 9, 1957, PL 85-315 was passed "to provide means of further securing and protecting the civil rights of persons within jurisdictions of the United States" (U. S. Statutes, 1957). This law centered around the issue of denial of voting rights to people because of race; the basic philosophy is of equal protection under the laws of the Constitution. On July 2, the Civil Rights Act of 1964 was passed to give relief from discrimination in public accommodations and public education. It called for affirmative action on nondiscrimination in federally assisted programs and in employment opportunity.

Thus, equal access legislation has been broadened to encompass many areas pertaining to an individual's life. Section 201 (A), states: "All persons shall be entitled to the full and equal enjoyment of the goods, services, facilities, privileges, advantages and accommodations, without discrimination or segregation on the ground of race, color, religion or national origin" (U. S. Statutes, 1964). As a result of the findings of the Civil Rights Commission, in 1967 the Age Discrimination in Employment Act was passed, which prohibited discrimination against an individual because of his or her age.

On October 14, 1972, PL 92-496 expanded the jurisdiction of the Civil Rights Commission to include discrimination because of sex. The same year the proposed Equal Rights Amendment stated: "Equality of rights under the law shall not be denied or abridged by the United States or by any state on account of sex" (U. S. Statutes, 1972).

From voting rights, we have moved to reaffirming equal access to housing, public places, employment, education, and equal protection for all under the rights of our Constitution, regardless of race, age, sex or national origin.

There appears to have been an oversight in this process: disabled

people. Employers still refuse to hire handicapped people because of alleged higher insurance costs; design professionals systematically exclude the handicapped from their buildings though ignorance or prejudice; equal education opportunities are a myth, as most schools are physically inaccessible.

As the movement against architectural barriers has progressed, the concept of civil rights for disabled people has taken on some specific meanings. In 1968, federal legislation was passed which established a commission with powers to "eliminate and prevent discrimination in employment, in places of public accommodation, resort or amusement, in housing accommodations, in commercial space, because of race creed, color, national origin or physical handicaps and to take action to eliminate such discrimination" (Design and Construction of Federal Facilities , 1960). The Law further defines a physically handicapped person as "a person who, because of accident, illness or congenital condition may depend upon a brace, crutch, cane, seeing eye dog, hand-controlled car or such other device or appliance in performance of his daily responsibilities as self-sufficient, productive and complete human being."

In 1970, in a paper submitted to the Department of Health, Education and Welfare, at the National Citizens Conference on Rehabilitation of the Disabled and Disadvantaged, Professor Richard E. Allen suggests that "in some areas, at least transportation, places of public accommodation and perhaps even employment in business and institutions, under federal regulations, there should be a federal civil rights law with appropriate sanctions directed to discrimination against the physically handicapped, whose effects are every bit as demeaning and as incapacitating as they are when directed against other citizens because of the color of their skin" (Allen, 1969).

People with severe visual impairments helped this concept grow, perhaps through being a more visible minority. This visibility made it easier to pass legislation protecting them against discrimination in places of public accommodation. These "white cane" laws, as they were called, were enacted in many states.

In 1972, PL 92-515 was passed "to enable the blind and otherwise physically disabled to participate fully in the social and economic life of the District of Columbia" (U. S. Statutes, 1972).

To participate fully in the social and economic life of a community closely embodies the spirit of the 1964 Civil Rights Act.

PL 91-453, the Urban Mass Transportation Act, which amended the 1964 Urban Mass Transportation Act, stated: "It is hereby declared to be the national policy that elderly and handicapped persons have the same right as other persons to utilize mass transportation facilities and services; that special efforts shall be made in the planning and

field of mass transportation (including the provisions under this Act) should contain provisions implementing this policy" (U. S. Statutes, 1970-71). The concept that people with disabilities are entitled to equal protection under the law and equal access to the environment is slowly being formalized in state and federal legislation.

While the classification of people with physical disabilities or others with mobility limitations has not been added to the language of the 1964 Civil Rights Act, the 1973 Rehabilitation Act and the 1974 Amendment to this act again embody the concept of the 1964 Act. Title V, Section 504 of PL 93-112, Rehabilitation Act of 1973, states: "No otherwise qualified handicapped individual in the United States, as defined in Section 7 (6) shall solely by reason of his handicap be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving federal assistance" (U. S. Code, 1973). The Rehabilitation Act Amendment of 1974 redefined Section 7 (6) so that a handicapped individual is a person who: "a) has a physical or mental impairment which substantially limits one or more of such person's major life activities, b) has a record of such impairment or c) is regarded as having such an impairment" (U. S. Statutes, 1974). This new definition broadens applicability of the discrimination clause. Section 504 was patterned after the antidiscrimination language of Section 601 of the Civil Rights Act of 1964, relating to race, color or national origin, and Section 901 of the Educational Amendments Act of 1972, relating to sex (U. S. Congressional and Administrative News, 1974).

This act in effect constitutes the establishment of a broad government policy that programs receiving federal assistance shall be operated without discrimination on the basis of disability. Section 504 enacted "to prevent discrimination against all handicapped individuals regardless of their need for or ability to benefit from vocational rehabilitation services in relation to federal assistance in employment, housing, transportation, education, health services or any other federally aided program" (U. S. Congressional and Administrative News, 1974). This act represents the most up-to-date legislation mandating the rights of people with disabilities. In 1977, HEW issued regulations that implemented the Rehabilitation Act, making "program accessibility" a requirement for programs receiving federal funds.

In the courts, gains have also been made. As a result of the Washington Metropolitan Transit Authority's lack of cooperation in providing full and equal access for people with disabilities, the Washington Urban League, the Paralyzed Veterans of America, the National Paraplegic Foundation, and Mr. Richard Heddings filed suit petitioning for declaration that Metro was in violation of federal law and sought an injunction against further construction (Laski, 1974). Metro officials contended that the PL 91-205 was simply an authorizing statute, and that an appropriation of $65 million was required before installation of elevators could begin. For three years, Metro officials held to this view until an injunction was issued preventing them from opening any stations not equipped with elevators. The lawsuit demonstrated how people with disabilities were formally excluded from benefits enjoyed by all citizens as a result

of general legislation. This subway system, which was financed through public taxes provided by all citizens, was to have been designed in such a manner that a certain class of citizens would have been unable to use it. This is contrary to the concept of equal access for all.

A second example of a court case concerning access is Friedman vs County of Cuyohoga. Jeffery Friedman, a law student, attempted to enter five county buildings in Cleveland. In each case entry was impossible. He filed a class action suit seeking a judgment as to the right of access and injunctive relief. He felt his constitutional rights and those of other people with disabilities were being denied. The case was argued, and won, around such issues as denial of access to the courts, denial of right to travel and freedom of movement, and denial of equal protection in that the barriers unjustifiably limited equal employment opportunity (Laski, 1974).

It is evident that, just as progress has been made in legislation, the right of access has also progressed through court action.

Policy for the Future

This country has developed policies of affirmative action to implement the right of equal employment opportunity; it must also develop policy to implement the right of access. This policy should focus on normalizing the life style of people with disabilities so that they have the same choices now available to able-bodied citizens. Thus, eliminating barriers in public buildings is not sufficient when people remain prisoners in their own houses or in institutions.

The countries of Sweden, Denmark and The Netherlands have different strategies of normalization, as accounted by Bednars (1974). In Sweden, the official policy has been to entirely eliminate special institutions for the mentally and physically disabled. This is being accomplished through development of small group homes or through alterations to individual dwelling units, and providing accommodations for education and other out-of-home activities in the same places that serve able-bodied people. Additional services such as special transportation or home aides for people with disabilities are provided by community agencies. In Denmark, the official policy is to develop multiservice rehabilitation centers to provide temporary residence and training for people with disabilities and then to either relocate them as soon as possible in community settings or provide permanent residence for those with severe disabilities at rehabilitation centers. In The Netherlands, an unofficial policy has stressed the normalization of institutions, utilized as sheltered places within which a normal style of life is developed. The primary example of this concept is Het Dorp, a community for about 500 severely disabled people, that was designed as a self-sufficient city enclave.

The size and diversity of situations within the U. S., combined with the emphasis on state and local control of institutions and community

planning, precludes a one-strategy policy in this country. However, the history of civil rights legislation and action argues for a rejection of the enclave approach, exemplified by Het Dorp, as the answer for all people with disabilities. This would be nothing less than a policy of segregation. Such living arrangements may, in fact, be preferred by some disabled people, but a policy mandating this approach as the only solution is clearly unacceptable.

The implications are quite clear. Accessibility to all places in a community is required for people with disabilities to live a normal life.

Conclusion

The civil rights of people with disabilities are slowly being guaranteed through legislation and court action. There are important policy implications associated with implementing legal guarantees. For other minorities, there are policies such as affirmative action employment programs, busing to insure school desegregation, and equal housing regulations. For people with disabilities, guarantees of civil rights imply a policy commitment to build and alter environments so that all people can negotiate them. Unless we design an accessible environment, including places for assembly, recreation, housing, education, health care and transportation, we will fail in providing for the rights guaranteed to all Americans under the Constitution. Specific policies should be developed to normalize life styles of people with disabilities. This requires careful consideration of community support systems, and mandates a policy of total accessibility so that one group of people is not unwillingly segregated from full participation in community life. These policies should strive to include disabled people under present civil rights legislation, and to mandate the elimination of architectural barriers in all places where barriers restrict attainment of rights. Finally, they should insure that elimination of barriers actually does occur.

It is encouraging to report that people with disabilities are actively working to achieve a national goal of total accessibility. They have many successes behind them and many more ahead.

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The Disabled Population

creation of a barrier-free environment into perspective. Who benefits from accessibility? This question is not as simple as it seems. Although, at first thought, one might answer, "People with disabilities", it may be that only people with a certain severity of disability benefit. Those with only a slight disability may have no serious problems in functional use of the environment, even without accessibility features. Moreover, what constitutes a disability? Disability has been defined as limitation in everyday activities, in work, in major activities, in personal care or in physical function. Depending on the definition used, the prevalence of disability differs. Finally, whose numbers do we use? There are several sources of statistics and there are differences among them.

This paper explores some of the available statistics on disability and presents an analysis of the target population for barrier-free design. It is limited to a discussion of people with permanent disabilities.

Prevalence and Extent of Disability

The commonly used definitions of disability are:

1. Having a chronic condition or impairment;
2. Unable to do certain physical activities, e.g. use hands, walk, etc.;
3. Limited in ability to do usual everyday activities, e.g. ability to work, keep house, attend church, participate in recreational functions, attend civic events;
4. Unable to work or do housework;
5. Restricted in mobility, e.g. move about freely;
6. Needing help for mobility or personal care.

Use of the first of these definitions is rare. Many chronic conditions or impairments have no affect on any aspect of human performance. The remaining five definitions, however, are frequently, but inconsistently, used to define disabled populations.

The statistics gathered by various U.S. Government agencies reflect differences in the definition of disability used because each agency gathers data for specific purposes. The three primary government sources of data on the noninstitutionalized disabled population are the National Health Interview Survey (1963 -   ) conducted by the National Center for Health Statistics, the 1970 Census and the Social Security Surveys of Noninstitutionalized Adults (1966).

The National Health Interview Survey (NHIS), conducted by the National Center for Health Statistics, annually interviews a consistent population sample of approximately 42 thousand households, comprising 134 thousand individuals (NCHS, Series 10, No. 32, 1966). These households are selected from the civilian, noninstitutionalized population of the

United States and cover all age groups. The survey questions focus on the individual's medical condition and health-service utilization to establish the prevalence of diseases and impairments, the extent of disability, and the volume and kinds of medical, dental and hospital care received. The extent of activity limitations is explored if a chronic condition, impairment (a physiological or anatomical loss or other abnormality) or acute condition is reported to be of longer than three months duration. Activity limitations are defined as limitations in the amount or kind of work (including housework) that the individual considers himself capable of performing. The sample is re-interviewed annually. A core of questions regarding the individual's health status and health-service utilization during the preceeding year is repeated. Questions regarding the individual's socio-economic adjustment to disability may change annually or are asked at intervals greater than one year.

The United States Census, conducted by the U.S. Bureau of the Census every 10 years, focuses on the measurement of labor force characteristics and participation. Disability is considered in the census only when the respondent is out of the labor force. Alternative reasons for not working or for not seeking employment are: "keeping house, going to school, retired, or unable to find work." The Census covers the entire noninstitutionalized population between 16 and 64 years of age. Persons who are classified as disabled must: 1) be unable to do any kind of work, 2) be "suffering from a definite illness or disability of longer duration and sufficiently serious to prevent working," and 3) must not be expected to be able to return to work within six months (Haber, 1967). Within this classification, the nature of severity of the disability is unidentified.

Because the NHIS and the Census define disability by different criteria (the ability to do housework represents a major discrepancy in definition, distorting prevalency estimates, particularly within the female population), their measures of disability prevalency are difficult to compare. The NHIS may, however, understate the prevalence of severe disability in the noninstitutionalized population (Haber, 1967). The NHIS reported approximately 1.5 million noninstitutionalized persons aged 17 to 64 unable to work or keep house during 1963 through 1965. This figure represented 1.4 percent of the 105 million persons in the United State's noninstitutionalized population in that age group (NCHS, Series 10, No. 32, 1965). The Census, however, reported approximately 2 million persons aged 20 to 62 (a more restricted age range than that employed by NHIS) who had not worked throughout 1965 due to illness or disability.

The Social Security Survey of Noninstitutionalized Adults (SSN) contains data collected in personal interviews with 8,700 disabled adults, ages 18 to 64; 30 thousand households were screened by mail questionnaires to identify the persons to be interviewed. Included in the SSN in 1966 were persons limited in the amount or kind of work (or housework) of which they were capable. Moreover, these limitations must have resulted from a chronic condition or impairment of at least three months duration (Haber, 1970).

terms of a specific medical problem. Activity limitations, however, are recorded in far more detail, dealing not only with work limitations but also with the inability to perform specific physical movement. Disability is categorized as "severe", and "occupational", or as a "secondary work limitation", depending upon the individual's response to a series of questions about labor force activity. Disabled adults unable to work regularly or at all are classified as severely disabled. Individuals for whom impairment did not lead to work related disability, but may nevertheless have affected personal care or recreational activities, are excluded from the survey.

The SSN reported that 17.7 million people between the ages of 18 and 64 (16.6 percent of the 1966 noninstitutionalized population) had a limitation in physical activity. About 5.9 percent of the population were classified as severely disabled in terms of physical abilities. By using a definition of disability broader than that used by the Census, the SSN identifies a much larger total disabled population , and a severely disabled population over twice the total identified by the Census in 1965. Discrepancies in the survey years and population age groups, however, restrict exact comparisons of the two data sources from published data.

Seventy-one percent of the total disabled population, identified by the SSN, indicated limited ability to perform at least one of the specified activities (stooping, lifting, using stairs, walking, or using one or both hands). Only 24 percent of the total disabled population, however, reported both physical activity limitations and that they required help for personal care (dressing, personal hygiene or eating) or for mobility (leaving their bed or home). Well over one-half of the persons stating both physical activity limitations and a need for help in personal care or mobility were also classified as severely disabled in terms of physical abilities. These persons comprised slightly less than 9 percent of disabled persons identified by the Social Security Survey and 1.5 percent of the total noninstitutionalized population, ages 18 to 64, in the United States in 1966.

The 9 percent of the total disabled population identified by the Social Security Survey as severely disabled and requiring help for personal care or mobility do not include visually handicapped persons who are able to perform the activities specified, but would nevertheless benefit from the removal of environmental barriers. Almost 36 percent of the 433 thousand persons reporting visual impairments as their major disabling condition in 1966 were classified as severely disabled by the survey (Haber, 1970). The requirements of visually impaired persons for help in personal care or mobility are not published. The inclusion of these people results in an addition of 155 thousand persons nationally to the expected 1966 beneficiary population, raising the total number of persons 18 to 64 years of age expected to benefit from the removal of environmental barriers to 1.72 million persons in 1966, or 1.7 percent of the 1966 U.S. population in that age group.

text of disability of people over 64 years of age. It reported about 8 million people, or 46 percent of the population, in this age group and 4.2 percent of the total population during 1965 and 1967 with a limitation of activity. About 4.5 million people, or 26 percent of those in this age group, and 2.3 percent of the total population during 1965 to 1967, were reported to have a limitation in ability to work or keep house. The NHIS reported 3.3 million people at this age or 19 percent of this age group and 1.7 percent of the total population, with mobility limitations in 1965 to 1967. About 1.1 million people in this age group "need help getting around"; this amounts to 6 percent of this age group and about 0.5 percent of the total population.

The NHIS is also the only source of data on disability for people under 17 years of age. For this group, 1.3 million or 1 percent of the entire population were reported to have a limitation of activity during 1965 to 1967. About 0.08 million people in this age group "need help getting around"; this amounts to 0.4 percent of the total population.

Because the SSN data does not include persons under 18 or over 64 years of age, it is impossible to compare the SSN total with that estimated by the NHIS for the entire noninstitutionalized population. Using 1969 data, the NHIS reported about 22.8 million people or 11.6 percent of the population with <u>activity</u> limitations. About 17.9 million people, or 9.1 percent of the total population had limitations in abilities to work, keep house or go to school. About 6.3 million people, or 3 percent of the total population had <u>mobility</u> limitations; of these people, 1.8 million or about 1 percent of the population, needed help in getting around but were not confined to the house. About 1.4 million, or less than 0.7 percent, were confined to the house.

In addition to these major public sources of data, Nagi (1975) completed a survey of disability in the U.S. among noninstitutionalized people 18 years of age and over. The survey includes data collected from 6,493 respondents who were interviewed as part of a survey of disability and the delivery of human services conducted in 1972. Nagi uses two basic measures of ability: 1) physical performance, i.e. sensorimotor functioning, and 2) emotional performance, i.e. effectiveness in psychological coping as manifested through anxiety, restlessness and other psychophysiological symptoms.

He studied the relationship of physical and emotional performance, health, sex, age, education, marital status, and race to work disability and independent living. Nagi concludes that work disability is to a large extent independent of physical and emotional performance. Moreover, socio-demographic characteristics do not fully account for the differences in work disability, even when physical and emotional performance are similar. He suggests that work disability may also be related to behavioral problems such as alcoholism, to job adjustments made by employers or employees themselves and to specific physical functions such as walking, bending, and climbing. Nagi's work suggests that work disability alone is not a reliable indicator of physical disability.

Table 1: Work Disability in the U.S.

	Percent	
U.S. population between ages 18 and 64 (1970)	100	112,580,427
Persons not limited in work roles and activities	89.4	100,629,842
Persons limited in work roles and activities	4.4	4,898,473
Persons disabled	6.3	7,052,112

Source: S.Z. Nagi, An Epidemiology of Adulthood Disability in the U

Table 2: Disability in Independent Living in the U.S.

	Percent	
U.S. population in 1970 (18 yrs. of age and over)	100	131,679,216
Persons not limited in living activities	88.4	116,408,232
Persons limited, but independent	6.3	8,233,757
Persons needing assistance in outdoor mobility, shopping and housework	3.5	4,664,446
Persons needing assistance in personal care, such as		

A primary finding of Nagi's survey is that dependency in living conditions is substantially related to physical and emotional performance when combined with specific health problems and socio-demographic characteristics. A dramatic increase is observed in the need for assistance in mobility and selfcare for people over 75. Dependence in living is found to be largely independent of work disability. Table 1 and 2 show Nagi's findings interpolated as estimates for the U.S. population.

Nagi proposes two definitions of severe disability:

1. For people 18 to 64, vocational disability--need for assisted living and servere physical and emotional limitations.
2. For people 65 years of age and over--need for assisted living and severe limitations in physical and emotional performance.

Nagi found 1.7 percent of his sample (a much smaller a proportion than identified by the SSN in 1966) could be identified as severelty disabled by these definitions. Projecting this rate to the U.S. noninstitutionalized population over 18 years old resulted in an estimate of about 2 million people for 1970.

<u>Limitations of Function</u>

Environmental barriers have specific impacts upon people with specific limitations to functional abilities. For example, the width of a door is only critical to people who use wheelchairs and walking aids. It does not affect use of a building by a person with severe impairments of vision. Thus, each barrier-free design feature may, in fact, have a different beneficiary population. An estimate of people with limitations of specific functional activities, similar to some of the measures used in the SSN and by Nagi, can be most useful in determining what part of the population would benefit from the removal of a class of environmental barriers. Unfortunately, no demographic study, to date, has used measures of functional abilities in a manner that would provide a full set of statistics. The NHIS, particularly, obtains data on chronic condition or impairment, e.g. paraplegia, heart disease, etc., rather than functional abilities.

The following is a list of functional limitations and definitions that are particularly important for using the physical environment:

A. Difficulty in Interpreting Information - individuals who have impaired abilities to read or reason and/or who have limited abilities to interpret complex information.
B. Severe Loss of Sight - individuals who cannot read ordinary newspaper print with eye glasses, who have legal blindness (20/200), or vision field defect of 10 percent or less.

stand usable speech with or without amplification.

D. Prevalence of Fainting, Dizziness or Poor Balance - e.g. individuals with Meniere's disease, hemiplegia, etc.
E. Incoordination - individuals who have difficulty in controlling and placing or directing their extremities, e.g. those with cerebral palsy or other neurological disorders.
F. Limitations of Stamina - individuals who become short of breath and/or experience an abnormal elevation in blood pressure from physical exertion, e.g. those with cardiopulmonary disorders or severe hypertension.
G. Difficulty in Moving Head - individuals limited in looking up and down or side to side.
H. Difficulty in Lifting and Reaching with Arms - individuals with decreased range of motion and strength of upper extremities.
I. Difficulty in Handling or Fingering - individuals who have difficulty performing functional activities with hands, e.g. one who has severe arthritis or fixed contractures from an injury such as a third-degree burn.
J. Inability to Perform Upper Extremity Skills - individuals with complete paralysis, lack of coordination or absence of upper extremities.
K. Difficulty in Bending, Turning, Sitting or Kneeling - e.g. individuals with severe arthritis of the spine or those in back braces and plaster body casts.
L. Reliance on Walking Aids - individuals who use leg braces or artificial legs and those who need crutches, canes or walkers.
M. Inability to Use Lower Extremities - individuals who are unable to move about except by use of a wheelchair.
N. Extremes of Size and Weight - individuals who are extremely tall, extremely short or extremely overweight.

Estimates of the prevalence of functional limitations in many of these categories can be developed by refering to the NHIS, the SSN, Nagi, and data available from organizations serving disabled people or supporting research on the elimination of chronic diseases. Table 3 gives estimates derived from such sources for people with severe limitations in each of the categories. The data from Nagi's study include only people who experienced great difficulty in the specified physical activities.

Nagi used the same items as the SSN but included people over 64 in his sample; his figures are used because they are more inclusive. A comparison of estimates of work disability from NHIS, the Census, the SSN, and Nagi's data for people 18 to 64 years of age indicates consistency between the last three sources. The NHIS appears to underestimate the severity of disability (Nagi, 1975) in its use of the category "unable to carry on major activity", thus, in Table 3 the

Table 3: Prevalence of Functional Limitations in the Noninstitutionalized U.S. Population (in mill

Limitation	Date	Estimate (in millions)	Age Group	Source
A. Difficulty in Interpreting Information	(No Data Available)			
B. Severe Loss of Sight	1970	1.7	All	American Foundation for the Blind
C. Severe Loss of Hearing	1974	6.8	All	National Association for the Deaf
D. Prevalance of Fainting, Dizziness or Poor Balance	1970	2.9	18 & Over	Nagi (fainting spells, dizziness, sick feelings)
E. Incoordination	(No Data Available)			
F. Limitations of Stamina	1963-1965	5.0		NHIS (limited activity[1] due to asthma-hay fever, heart conditions, hypertension & other respiratory conditions)[2]
G. Difficulty Moving Head	(No Data Available)			
H. Difficulty in Lifting and Reaching with Arms	1970	11.8	18 & Over	Nagi (great difficulty lifting 10 lb weights or reaching with arms)
I. Difficulty in Handling or Fingering	1970	3.0	18 & Over	Nagi (great difficulty using hands and fingering)
J. Inability to Perform Upper Extremity Skills	1963-1965	3.6	All	NHIS (limited activity due to impairment of upper extremity and shoulder)[1,2]
K. Difficulty in Bending, Turning, Sitting or Kneeling	1970	10.0	18 & Over	Nagi (great difficulty stooping, kneeling & crouching)
L. Reliance on Walking Aids	1969	6.6	All	NHIS (use of crutches, braces, canes, walkers, artificial limbs)
M. Inability to Use Lower Extremities	1969	0.4	All	NHIS (wheelchair users)
N. Extremes of Size and Weight	(No Data Available)			

[1]Includes both those "limited in amount and kind of major activity" as well as "unable to carry on major activity."

[2]Does not include paralysis and absence of limbs.

Table 4: Beneficiaries[1] of Barrier Elimination Who Would Benefit Due to Increased Independence in Personal Care and Mobility Using NHIS and SSN Data

Age	% of U.S. Population	Date	Source
Under 17	0.04	1965-1967	NHIS (limitation of mobility such that "needs help getting around")
18 - 64	1.7	1966	SSN (severely disabled and needing help with personal care or mobility, plus severely disabled with visual impairments)
65 plus	0.5	1965-1967	NHIS (limitation of mobility such that "needs help getting around")
Total	2.2		

[1] Noninstitutionalized people only.

cagegory "limitation in amount or kind of major activity" is combined with "unable to carry on major activity" for the NHIS figures with the exception that <u>all</u> people who use walking aids and wheelchairs are included in Limitation M.

Although data for four of the functional limitations is not available, there are data on specific segments of the population who may experience such limitations. For example, mentally retarded children may have difficulty interpreting information and people with Parkinson's disease may have incoordination; however, without data on the severity of such conditions, with respect to work or independent living, no reliable estimate of the actual functional limitations of such people are known.

<u>Target Population for Barrier-Free Design</u>

Returning to the question posed at the beginning of this paper, "Who benefits from accessibility?", we can now attempt to answer in terms of the data presented above. The most conservative view of beneficiaries would be those who could obtain increased independence in personal care and/or mobility through elimination of barriers. Table 4 identifies such people using data from the SSN wherever possible, since it appears to provide more reliable estimates of severe disability than the NHIS. Using the NHIS and the SSN data, 2.2 percent of the population would be a conservative estimate for the beneficiary population.

Nagi (1975) found that 1.7 percent of the population over 18 years of age could be classified as severely disabled by his definition. However, Nagi's definition specifies that a person under 64 years of age must have severe limitations in emotional and physical performance, as well as requiring assisted living arrangements, in addition to work disability, to be "severely disabled". The SSN criteria, formulated exclusively on work disability, were less restrictive and, therefore, identified a larger severely disabled population (5.7 percent).

Nagi also found that 3.5 percent of the population 18 years and older required assistance in outdoor mobility and another 1.8 percent in personal care -- a total of 5.3 percent who need assistance in independent living alone. Nagi's estimate for people who only need assistance in independent living, including mobility outdoors, results in a much larger estimate -- one that exceeds the SSN-HNIS estimate of persons requiring help for personal care or mobility by 3.1 percent. This second estimate from Nagi can be considered a "moderate estimate" for defining the target population of barrier-free design. It is not restricted only to people who are severely disabled in terms of physical and/or emotional performance, and includes people who may not be limited in work. Although Nagi's data do not include people under 18, it is expected that their addition would have insignificant effects.

Thus, a conservative estimate of the principal beneficiaries for elimination of barriers given available data, is from 1.7 to 2.2 percent of the entire population. A moderate estimate is 5.3 percent of the entire population. These estimates exclude many people who might benefit, even though their limitations are less severe, and those in institutions who might be able to pursue more independent lives; but they also may include people who cannot benefit because of the severity of their disability.

A liberal view of the beneficiary population would include, not only those who would achieve increased independence in personal care and mobility, but also those who would gain a fuller degree of independence and mobility and more convenience in everyday activities. An estimate of this beneficiary population is the 22.8 million people, or 11.6 percent of the U.S. population, reported by NHIS (1969) to have some limitation in everyday activities, but not necessarily in a major activity.

Another figure for this group of people is based on Nagi's estimates and would include all those people who are "limited but independent", "needing assistance in outdoor mobility, shopping and housework" and "needing assistance in personal care". This amounts to 15.3 million people or 11.6 percent of the adult population in 1970. Thus, using liberal estimates, it appears that approximately 11.6 percent of the total population would benefit from elimination of environmental barriers.

The concept of a barrier-free environment refers to accessibility for a broad range of people. However, within the set of items necessary to achieve an accessible environment for all people, not every item has an impact upon each individual. Another way to arrive at an estimate target population, therefore, is to determine who will benefit from removal of specific barriers. This can be done, to a very limited extent, by using Table 3. For each accessibility item, one can determine which people with respect to functional limitation, will benefit; the total number of people having those limitations can be summed. The following examples illustrate this approach:

1. A minimum gradient for walks or ramps aids people who use wheelchairs and walking aids and those with low stamina - total 12 million.
2. Inclusion of raised numerals on elevator panels aids people with severe loss of sight - total 1.7 million.
3. Locating parking spaces close to the entries of a building aids people who use wheelchairs, those who use walking aids and those with low stamina - total 12 million.

There are some major limitations on using the data from Table 3 in this way:

in over estimates or under estimates in each category.

4. There are gaps in the table.

Comprehensive data on functional limitations from a single source or several sources using comparable survey methods would improve the potential of using this third method for estimating the target population.

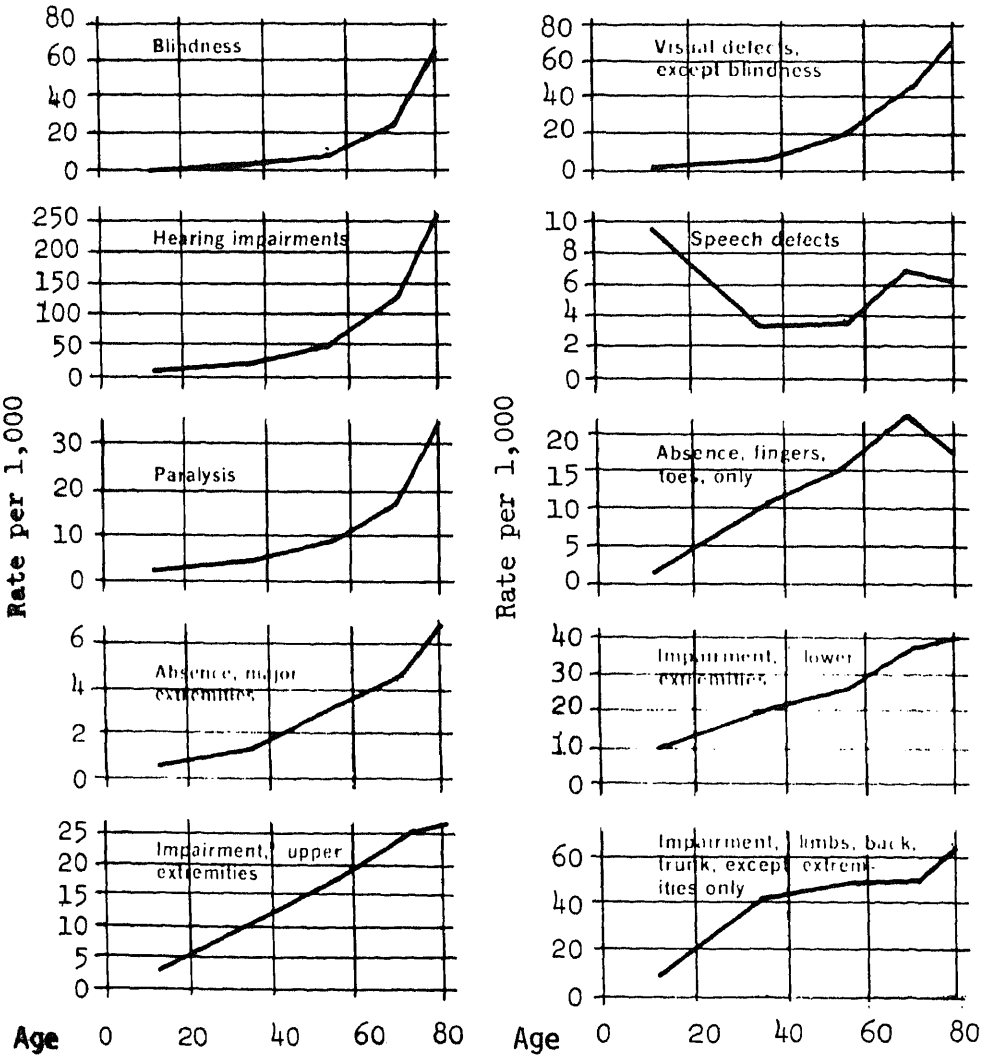
Modifying Factors

The compilation of statistics on disability alone is not sufficient for estimating the actual population who would benefit from removal of environmental barriers in specific places. Although the literature is scarce on the modifying influence of demographic characteristics, there is enough evidence to make some general observations about beneficiary populations estimated without regard to demographic characteristics.

First, the degree and severity of disability increases greatly with age. About 46 percent of the population over age 64 were reported to have a limitation of activity (HNIS, 1965-1967), compared to 11.6 percent for the general population (NHIS, 1969). Nagi found that needs for assistance in mobility and personal care increased significantly from age 45 and up. At each 10 year interval in age, rates doubled in most cases. Among those people age 75 plus, 40.5 percent had limitations in independent living (Nagi, 1975, p 28). Figures 1 and 2 show the relationship of age to specific chronic conditions and impairments. The strong positive relationship of age and disability implies that the removal of environmental barriers from buildings used extensively by the elderly, would benefit a much larger number of people than suggested by cross-sectional data. For example, using Nagi's data, about 40.5 percent of all those people <u>now living</u> who eventually reach the age of 75 may be beneficiaries.

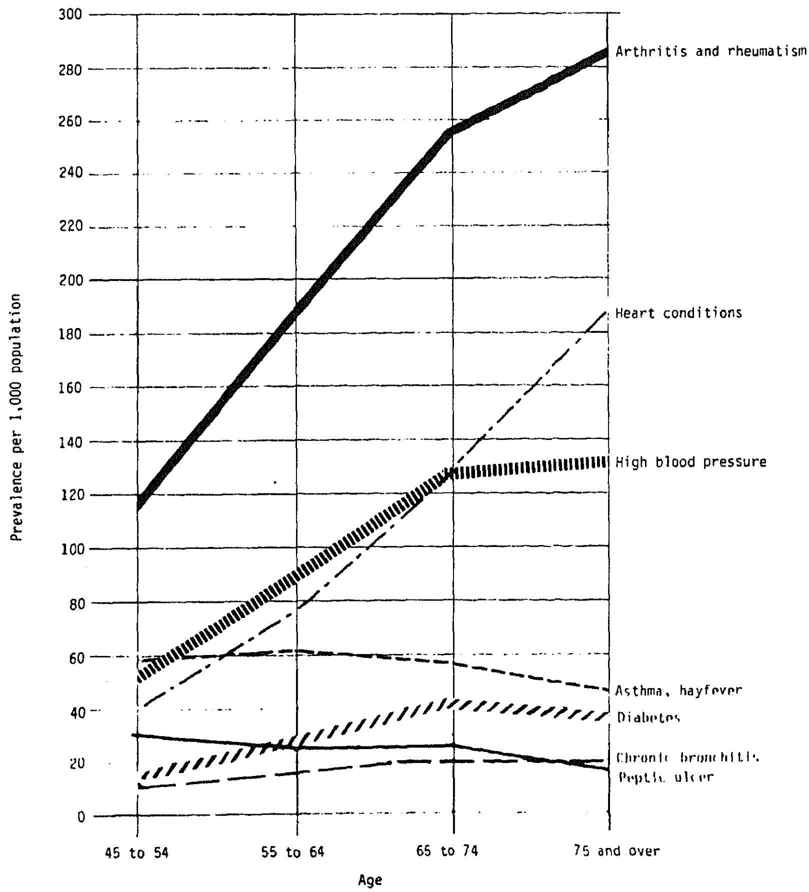
Second, the distribution of disabled and elderly people varies by region, state and degree of urbanization. Figures 3, 4 and 5 demonstrate the proportion of disabled and elderly people by state. Figure 5 shows the states and regions of the country in which the proportions of disabled and elderly people are greater than would be expected based on the ranking of the state in terms of its size. There is also an indication that the incidence of disability <u>within</u> age groups varies from region to region, and with degree of urbanization. For example, the NHIS data show that elderly people in the Northeast reported mobility limitations more frequently than their counterparts of the North Central or Western regions of the U.S. but considerably less often than elderly persons in the South (NHIS, 1972). This variation cannot be exmplained by the traditional building types of these regions. It may be related to migration patterns and the attriactiveness of warm climates to people with specific kinds of disabilities. The NHIS data also show that there are differences in the incidence of disability among the elderly according to residence within a Standard Metropolitan Statistical Area.

FIGURE 1: Specific impairments by age, United States, 1957 to 1958.



*Except paralysis and absence

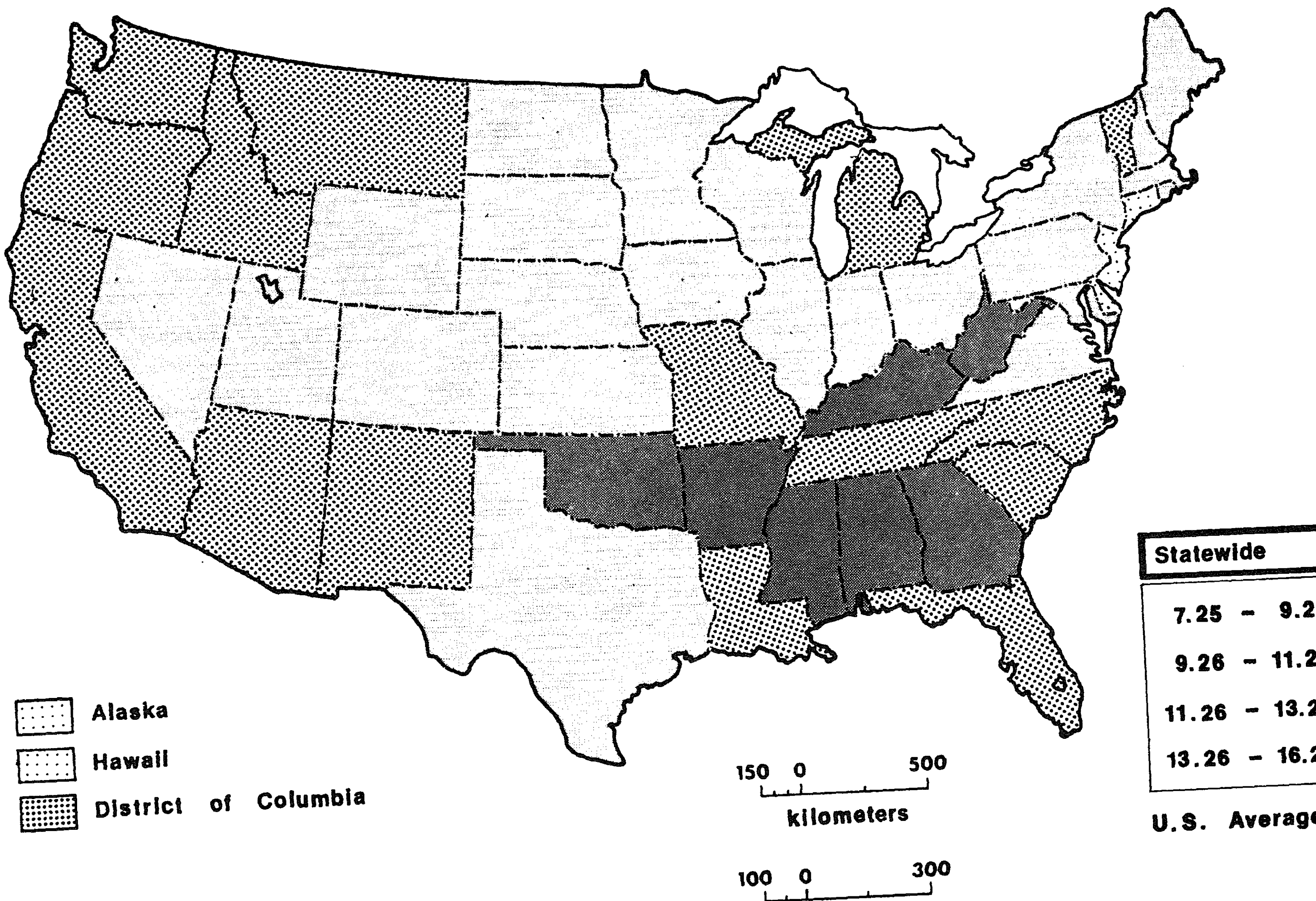
FIGURE 2: Prevalence of selected chronic illnesses among persons 45 and ove[r]
United States, 1957 to 1959



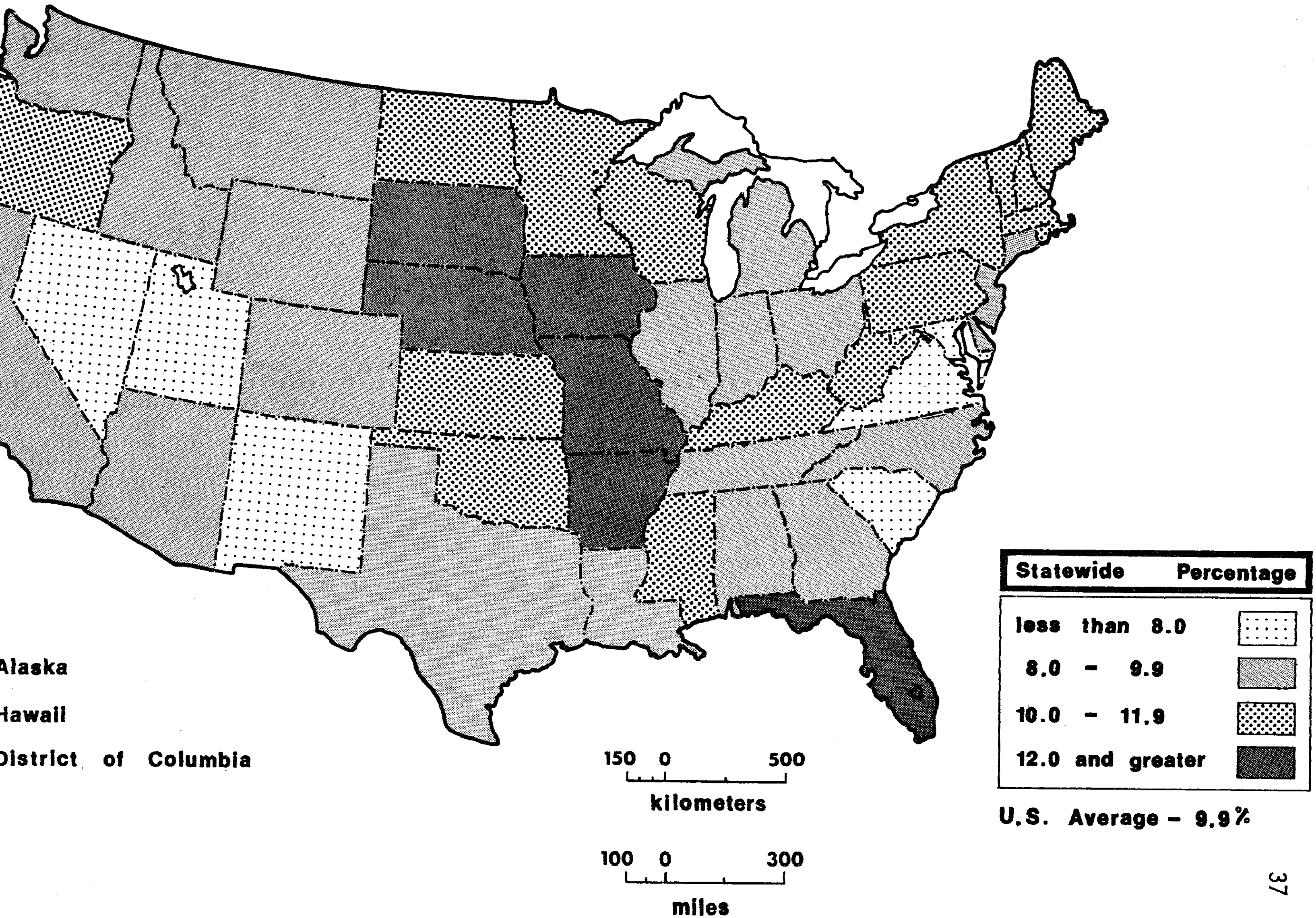
Source: United States National Health Survey, 1960. Health Statistics.

3: 1970 Distribution of Disabled Persons – Ages 18 thru 64

Source : Rehabilitation Services Administration, DHEW

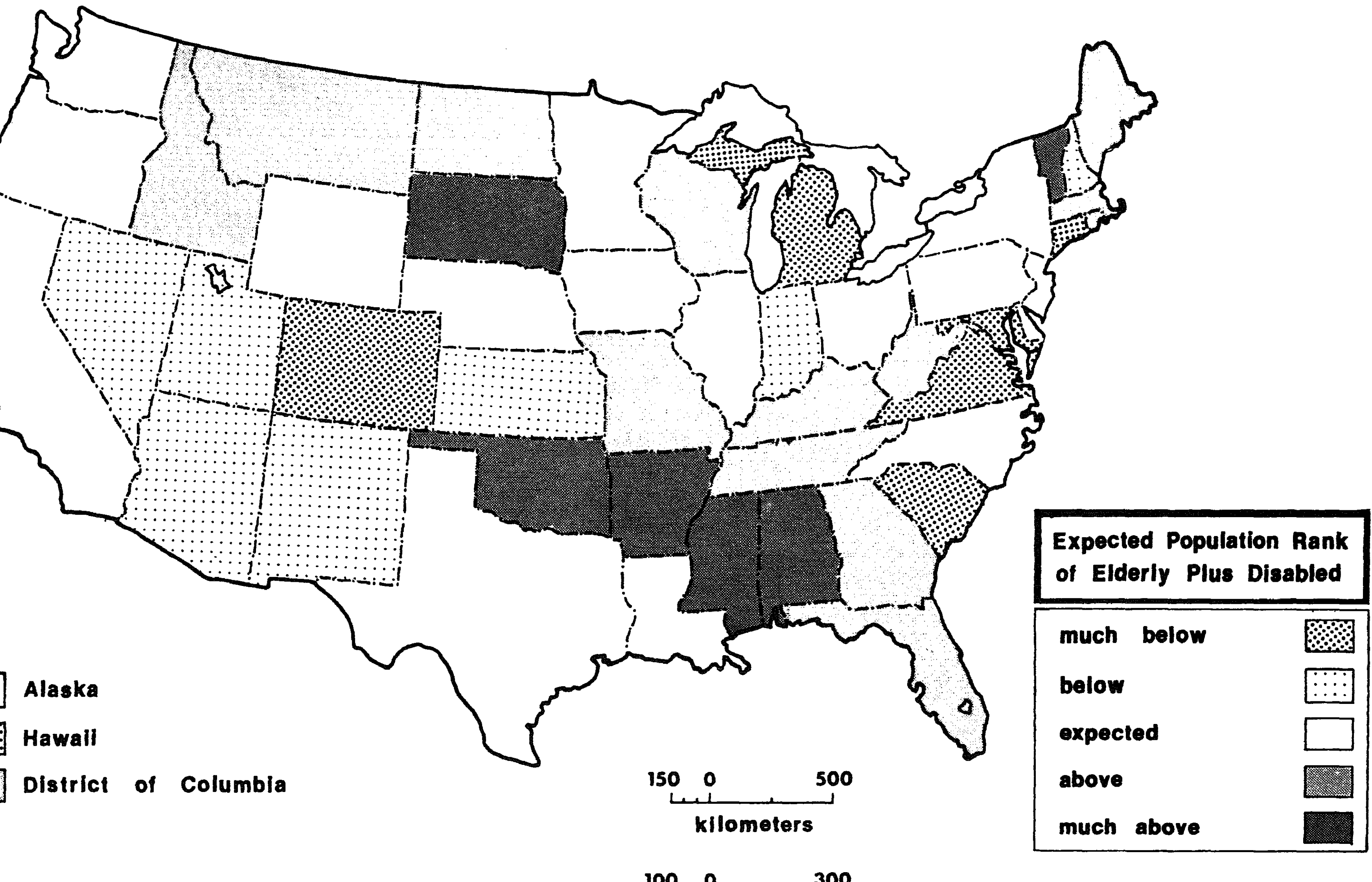


: Brotman, Herman B. and Blanch S. Williams, Facts and Figures on Older Americans: State Trends 1950-1970, Washington, D.C.: AOA, 1973, pg. 10



70 Residuals by Population Rank (Elderly Plus Disabled)

rce: Hal Sommers



For example, elderly people who were nonfarm residents outside a SMSA, presumably in smaller urban areas, reported the highest rate of mobility limitations among the elderly population (NHIS, 1972). Elderly people living in SMSA's, but outside central cities, reported the lowest rate of disability (NHIS, 1972). The same relationships were found among people under 17 years of age. These findings imply that the size of the target population will vary in a complex way, based on the location of a building or facility.

A third modifying factor is the utilization rates of buildings by disabled and elderly people. A disability itself, or other factors associated with disability and/or advanced age, may preclude or dissuade an individual from participating in an activity. Although many disabled and elderly people lead very active lives, there is evidence that the onset of a disability can lead to reductions in some activities (Haber, 1970). The extent to which this reduction is due to inaccessibility of the environment, low income or factors other than disability itself is not known. Haber's data for people aged 18 to 64 show that only 50 percent of those people disabled after the age of 18 did as much or more shopping and only 45.6 percent participated in as much or more social interaction. For severely disabled people, these rates dropped to 34.7 percent and 26.3 percent, respectively. This implies that, if the removal of environmental barriers in themselves have no or little effect on the motivation of people to participate in certain activities, the population expected to benefit from removal of environmental barriers must be adjusted by expected utilization rates. Exceptions include housing and primary and secondary public schools where utilizations is fixed by need or by law. Other demographic factors -- such as sex, race, marital status and education may modify expected utilization rates, where utilization is a matter of individual preference.

<u>Summary</u>

Several alternative definitions of disability can be used to generate estimates of persons in the U.S. population expected to benefit from the removal of environmental barriers. Using the most conservative definition, "the need for mobility and/or personal care", together with "severe disability", results in an estimate of 1.7 to 2.2 percent of the noninstitutionalized population. Using a moderate definition, "need of help for mobility and/or personal care", results in an estimate of 5.3 percent of the U.S. population. Using the most liberal definition, "individuals limited in ability to do any usual everyday activity", results in an estimate of over 11.6 percent of the population. The first two estimates exclude many who would probably benefit to a limited extent from removal of environmental barriers, even though their disabilities are not severe. All estimates may include some people who would not benefit at all because their disabilities are too severe and exclude those in institutions who may benefit from increased opportunity to live independently. Estimates based on the major sources of data vary due to differences in the definitions used to define disability and the population included in the sample.

ment, e.g. doors and stairs, can be measured by determining how many people have limitations of action that result in problems in using the. There is no comprehensive data base for statistics on limitations of physical activities although some data can be pieced together from available sources (see Table 3).

Estimates of the number of people expected to benefit from removal of environmental barriers in a building or facility cannot be based solely on the proportion of disabled people in the U.S. population. The effect of demographic factors on behavior must be considered. Since disability is highly related to age, a longitudinal perspective on the expected beneficiary population is desirable. That is, projections of future utilization might vary significantly if the age distribution of the total population (in particular, the rate at which the total population is aging) is considered.

In addition, the prevalence of disability is related to geographic location. The expected beneficiary population might vary significantly according to the location of a particular building or facility. The influence of location as observed by region and state, as well as by location within a metropolitan area.

Finally, there is evidence to indicate that, for some community-based activities, participation decreases with the onset of a disability. Thus, the expected rate of utilization of a building or facility by people with disabilities must be considered in estimating the size of the population who will benefit.

A great deal more research in the demography of disability is needed to provide more accurate and reliable estimates on the population that will benefit from removal of environmental barriers. Satisfying the following information needs would improve the state-of-the-art significantly:

1. Comprehensive, reliable and standardized data on the functional limitations for specific physical activities.
2. Data on temporary limitations of activity and mobility that may cause difficulty in using buildings and facilities.
3. Information on the impact of accessibility upon the utilization of specific building types by disabled people.
4. Additional knowledge about the relationship between geographic location and disability.
5. Information on the ability of institutionalized people to live more independent lives if environmental barriers are removed in housing, places of employment and placed used by the public.

Although this report focused on the extent of disability in the U.S. population, it should be noted that people without impairments also benefit from improved accessibility of buildings. More research on

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Accessibility Codes And Regulations

4

The following report presents findings of a state-of-the-art review of building codes and other regulations concerning the elimination of environmental barriers for physically disabled people. The survey includes regulations promulgated by federal agencies, states and cities, as well as national model building codes and appropriate building regulations from other Western nations.

Using the major elements of ANSI A117.1 (1961, R1971) "Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped" as a baseline for comparison purposes, codes and other regulations were reviewed by surveying the use and adoption of ANSI A117.1 by domestic agencies, as well as identifying additions, changes and substitutions that such agencies made for specific criteria in that standard. In this manner, various sections of ANSI A117.1 can be identified as areas of general consensus, as areas that have generated numerous alternative or more defined criteria, or as areas indicating a need for additional research. In addition to the identification and review of codes and regulations, the applicable statutes and mechanisms for enforcement and design review have also been identified for all the states.

Federal Regulations

After the passage of Public Law 90-480 in 1968, the federal government gained responsibilities for the accessibility of projects constructed, altered, leased or financed, in whole or in part, with federal monies. Congress prescribed that the Administrator of the General Services Administration develop standards for buildings financed, in whole or in part, with public funds other than residential and defense related buildings. The responsibility for development of standards for residential facilities and facilities of the Department of Defense were, respectively, given to the Secretary of Housing and Urban Development and the Secretary of Defense, each consulting with the Secretary of Health, Education and Welfare (U.S. Statutes at Large, 1969).

A survey prepared by the Subcommittee on Barrier-Free Design of the President's Committee on Employment of the Handicapped was used to ident agencies with in-house regulations or guidelines. Those with extensive additions to ANSI A117.1 were requested and reviewed (see Table 1). In addition, the General Services Administration, perhaps the most visible federal agency dealing with construction of public buildings and facilities, was contacted for comments and suggestions regarding the role of building standards, ANSI A117.1 in particular, in achieving accessible environments.

The comparison of federal agency regulations or guidelines (see Table 2) with ANSI A117.1 shows that virtually all agencies either have, or are developing, documents with numerous variations from ANSI A117.1. The most recent federal guidelines illustrate a change in emphasis from an initial concern with only building entrances to total accessibility and usability. Agencies concerned with specific building

Table 1: Federal Agencies with Extensive In-House Guidelines

Agency	Publication
Department of Defense (Army)	Engineering and Design: Design for the Phy Handicapped, Manual No. 1110-1-103
Department of Health, Education and Welfare: Office of Higher Education Facilities Office of School Construction Health Service and Mental Health Assn. National Institutes of Health Rehabilitation and Social Services	Technical Handbook for Facilities, Engineer Construction Manual, Part 4, Section 4.12: of Barrier-Free Facilities"
Department of Housing and Urban Development	Minimum Property Standards for Multifamily
Department of Agriculture, Soil Conservation Services	TSC Technical Notebook, Recreation UD-16: " ments for Planning Public Facilities for the capped"
Public Buildings Service, General Services Administration	Design Criteria: New Public Building Access
Veterans Administration	VA Construction Standards, CD-8: "Accommoda the Physically Handicapped"

Note: Other agencies also have guidelines; these were chosen as being most representative and for the broad range of buildings constructed by federal agencies.

Table 2: Federal Agency - ANSI A117.1 Comparison of Scope

	ANSI A117.1 (1961, R1971)	Differences from ANSI A117.1 (1961, R1971)					
		Dept. of Agriculture Soil Conservation Service	Dept. of Health, Education & Welfare	Dept. of Housing & Urban Development	Veterans Adminis-tration	General Services Administration	Dept. of the Army
A. Site Development							
Grading	X						
Walks	X	X	X	X	X	X	X
Parking Facilities	X	X	X	X	X	X	X
Site Furniture					X	X	X
B. Building							
Ramps	X	X	X	X	X	X	X
Floors	X	X		X	X	X	X
Elevators	X		X	X	X	X	X
Entrances	X	X	X	X	X	X	X
Doors & Doorways	X	X	X	X	X	X	X
Corridors			X	X	X	X	X
Stairs	X	X	X	X	X	X	X
Toilets	X	X	X		X	X	X
Lavatories	X	X	X		X	X	X
Special Spaces			X	X	X	X	X
Furniture Layouts			X	X	X	X	X
C. Products, Controls, Information							
Water Fountains	X	X	X		X	X	X
Public Telephones	X		X		X	X	X
Warnings	X		X	X	X	X	X
Identification	X				X	X	X
Controls	X		X	X	X	X	X
Furniture				X	X	X	X

Table 3.A: Federal Agencies - Department of Agriculture, Soil Conservation Service

Differences from ANSI A117.1 (1961, R1971)	
Walks	Feathered edges; no drop offs
Parking Facilities	No passage allowed behind parked cars; 30 in minimum openings between curb stops
Ramps	Maximum length between rest areas: 20 ft - 0 in; rest area at least 3 ft - 0 in long
Floors	List of suitable materials
Entrances	One main entrance accessible
Doors and Doorways	Flush threshold; handles 3 ft - 6 in high; vestibule 6 ft - 6 in
Corridors	5 ft - 0 in wide, exclusive of protruding features
Stairs	"Replace with ramps where feasible."
Toilets and Lavatories	Toilet stall: 60 in minimum depth; lavatories: 30 in knee clearance; lever faucet controls; no exposed hot water pipes
Water Fountains	36 in maximum height; no alcove placement

Table 3.B: Federal Agencies - Department of Health, Education and Welfare

A. Differences from ANSI A117.1 (1961, R1971)	
Walks	Minimum width: 48 in; rest areas provided at 60 ft intervals where gradients exceed 3%; level platform 5 ft beyond the door swing; handrails required where grade drops sharply within 3 ft of walk
Parking Facilities	Suggests number: (minimum of 2 or 1%); located maximum distance of 200 ft from accessible entrance; spaces identified with international symbol of accessibility; space width: 13 ft
Ramps	Minimum width: 48 in; landings 60 in long at top and at 30 ft intervals; guardrails (32 in high) and curbs (2 in high) required where grade drops at either side
Entrances	Alternate path of travel must be provided where turnstiles or revolving doors are present; identified by international symbol of accessibility; vestibule depth: 6 ft - 6 in
Doors and Doorways	Opening force: 8 lb; level floor extend 5 ft beyond door swing; threshold with maximum 8% beveled slope allowable
Stairs	Minimum width: 42 in; handrails at 32 in required both sides; must be well illuminated at all times
Floors	Transition strips between carpet and other materials are required
Toilet Rooms	Number defined: 1 per floor per sex; clear turning area required of 60 in x 60 in; provisions for side transfer stall: 60 in wide x 60 in deep; 34 in wide clear opening out-swinging door; 38 in high grab bar mounted on one side; provisions for front transfer stall: same as ANSI but specifies grab bar length (52 in)
Lavatories	Provide 30 in clear space below for depth of 10 in from front rim with wrist blade or single lever faucets and drain insulation
Urinals	Must project minimum of 18 in from wall
Public Telephones	Defines number: at least one per bank; highest operable part: 48 in; cord length: 36 in minimum; one per bank equipped with amplifier
Elevators	Call buttons centered at 40 in; cab size: 63 in x 56 in; door clear opening: 32 in; handrail: 32 in high required on one wall; operation must be automatic; highest control: 48 in
Controls	Height: 48 in maximum; outlets: 18 in minimum; operating force not to exceed 8 lb
B. Additions to the Scope of ANSI A117.1 (1961, R1971)	
Shower Stalls	Recommendations for size (36 in square); folding seats (both sides at 19 in); grab bars (33 in high); controls, etc.
Special Spaces	Dining areas must be directly accessible with recommendations for tray slide height, aisle widths and table underside clearance; spectator spaces: recommendations; laboratories: recommendations; libraries: must provide accessible study carrels and tables; audio-visual: recommendations; dormitory bedrooms: recommendation

able 3.C: Federal Agencies - General Services Administration

A. Differences from ANSI A117.1 (1961, R1971)

Walks	Minimum width for 2-way flow: 60 in
Parking Facilities	Minimum width: 12 ft - 6 in; number of reserved spaces differs for visitors and employees; location: 300 ft maximum distance from accessible entrance
Ramps	Maximum slope: 1:6 when rise is less than 8 in, 1:12 otherwise, 1:20 preferred; handrails required where vertical rise greater than 8 in; handrail height: 32 to 34 in with 12 in extensions at top and bottom; minimum width: 2-way -60 in, 1-way - 36 in; curbs: 2 in high required at sides; maximum length between landings: 30 ft, 15 ft preferred
Entrances	Minimum clear width opening: 36 in at each accessible entrance
Doors and Doorways	Thresholds of 1/4 in maximum allowable
Stairs	Handrail height: 32 to 34 in, both sides with 12 in extensions; maximum riser height: 7 1/2 in; minimum width: 44 in; minimum tread depth: 10 in
Toilets and Lavatories	Number: 1 per floor per sex (where toilet rooms provided); stall width: 66 in; depth: 60 in; with L-shape grab bar and center line of water closet 16 in from wall
Elevators	Location: 100 ft from accessible entrance; clear floor space allows wheelchairs to turn 180°; minimum door width: 36 in with door reopening devices; nonslip flooring; mixímum level change: 1/2 in; handrails required on 3 sides at 32 to 34 in; dual-mode floor arrival signals; call buttons: 3/4 in minimum at 42 in high; control buttons: 48 in maximum, 30 in minimum; tactile characters; 2-way emergency communication; floor identification required at door jamb
Water Fountains	Number: 1 per 20,000 sq ft; spout height: 30 to 34 in; alcove width: 60 in
Public Telephones	Maximum height: 48 in; clear space in front: 60 in x 60 in
Controls	Highest operable part to be 48 in from floor
Identification	Provisions for communication/identification system with additional requirements relating to size, shape, illumination, intelligibility, etc.
Warnings/Hazards	Hazards and warnings are included within the scope of the communication/ identification system provisions

Additions to the Scope of ANSI A117.1 (1961, R1971)

GSA has extensive requirements beyond the scope of ANSI A117.1 (1961, R1971). For purposes of simplification the building elements are listed here without the specific criteria:

Curb Ramps; Drop-off Zones; Plazas; Site Furniture; Corridors; Emergency Equipment; Communication/Identification Networks; Employees' Use Areas and Special Spaces; Auditoria; Lobbies; Dining Facilities; Libraries; Offices; Storage; Locker Rooms; Commercial Facilities; Credit Unions

Table 3.D: Federal Agencies - Department of Housing and Urban Development

A. Differences from ANSI A117.1 (1961, R1971)	
Walks	Maximum distance from parking to accessible entrance: 150 ft; separate common facilities to be connected by covered walks
Exterior Stairs	Handrail extensions required when flight rise is less than 24 in and width is greater than 4 ft, otherwise railing on only one side is required
Elevators	Where required: 3 or more stories in housing for elderly, 2 or more stories where accessible units are not on the first floor; floor passage and arrival signals required in 3 stories or more; minimum door size: 3 ft
Doors and Doorways	Entrance to dwelling unit: 3 ft clear opening; all others: 2 ft - 8 in
Stairs	Maximum riser height: 7 1/2 in, open risers not permitted
B. Additions to the Scope of ANSI A117.1 (1961, R1971)	
Halls and Corridors	Building corridors: 60 in minimum width; dwelling unit: 40 in; railings on one side
Public Dining Facilities	Table space per wheelchair user: 2 ft - 1 in x 3 ft - 6 in
Bedrooms	Beds accessible from two sides and one end
Bathrooms	10% of all units have accessible bathrooms with 60 in long bathtubs with 2 grab bars; shower stalls acceptable if 4 ft sq without curbs and with grab bars
Foyers	Required in housing for elderly where there is direct outside access to cold climates
Kitchens	One-half of the 10% with accessible bathrooms shall have accessible kitchens (storage and layout requirements)
Controls	Heating system layout; illumination intensities; call system in projects in excess of 20 units

able 3.E: Federal Agencies - Veterans Administration

\. Differences from ANSI A117.1 (1961, R1971)	
Walks	Width: 72 in; maximum slope: 3%; rest areas every 200 ft for walks with 2 to 3% slope
Parking Facilities	Width: accessible space between regular parking space 13 ft - 6 in; series of accessible spaces 9 ft - 0 in wide with clear space 4 ft - o in wide
Ramps	Slope: 4 to 8% (5% preferred); handrails on both sides; width: 4 ft - 0 in between curbs; curbs: 4 in x 4 in; level platform: 5 ft - 0 in long (minimum); weather protection required
Floors	Carpets must be tight weave, low pile
Elevators	Call buttons at 3 ft - 4 in; audible signals for up and down direction; 36 in door; 7 lb pressure; double handrails (32 in and 42 in); minimum space: 5 ft - 8 in x 5 ft; auxiliary call buttons
Entrances	Entry platforms 6 ft x 6 ft; 18 in each side of doorway (single), 12 in (double); level and at grade vestibules 6 ft - 6 in deep
Doors and Doorways	34 in clear opening; opening pressure: 8 lb (5 lb preferred); flush thresholds; lever handles preferred
Stairs	Handrails on both sides; does not catch clothes; treads with nosings of contrasting colors
Toilets and Lavatories	Required at visitor's entrance level; urinals: handle at 40 in, lip at 15 in; 3 ft wide entrance door; provide for side transfer; conventional: 3 ft - 6 in wide x 6 ft - 6 in deep, 34 in door; parallel grab bars at 30 in; center water closet with 20 in seat; lavatories: VA Guide
Water Fountains	Required alcove placement; rim at 34 in; knee clearance at 27 in
Public Telephones	Number 1 per floor; push buttons required
Warnings	Warning lines at: walk-traffic intersection, stairs, doors, on glass doors
3. Additions to the Scope of ANSI A117.1 (1961, R1971)	
Curb Ramps; Tables; Furniture Selection; Ash Trays; Special Spaces: Cafeterias, Stores	

Table 3.F: Federal Agencies - Department of Defense (Army)

A. Differences from ANSI A117.1 (1961, R1971)	
Walks	Walks subject to use by handicapped people: at least 6 ft - 0 in wide; maximum slope: 4.2% (1:24); where slopes exceed 1:30, provide landings 6 ft - 0 in x 6 ft - 0 in at 60 ft intervals; level platforms: 6 ft - 0 in x 6 ft - 0 in, extending 18 in beyond latch side of door; provisions for vertical and side clearances
Parking Facilities	Number of accessible spaces defined; location must be within 100 ft of accessible entrance; space width: 13 ft - 0 in; 6 ft wide walk in front of parked cars; identify accessible spaces
Ramps	Minimum clear width: 6 ft - 0 in; landings 6 ft - 0 in x 6 ft - 0 in at top and bottom; landings at doors same as walk provisions
Entrances	Identify accessible entrances with international symbol of accessibility
Doors and Doorways	Minimum door width: 36 in; maximum opening force: 15 lb (exterior), 5 lb (interior); time delay provisions for automatic door operators; hardware: lever type or horizontal bar, 36 in to 42 in from floor; kickplates 16 in high required; level floors: 6 ft (pull side), 4 ft (opposite side); 18 in level area at latch side; vestibule depth: 7 ft - 0 in between closed doors; maximum threshold height: 1/4 in
Stairs	Minimum width: 4 ft - 0 in; landings: 4 ft - 0 in x 4 ft - 0 in; maximum rise between landings: 6 ft (4 ft in exposed weather); riser height: 5 in to 7 in; tread width: 11 in to 17 in; no open risers; nosings: round or 45 in bevel, contrasting color; handrails: 32 in to 34 in high, both sides; 18 in extensions recommended; provisions for handrail shape, wall clearance and loading condition
Floors	Maximum level changes: 1/4 in
Toilet Rooms	Number defined: 1 per sex per floor; maximum distance to accessible toilet room: 150 ft; stall size: front transfer - 36-33 in wide by 72 in deep, side transfer - 66 in wide by 72 in deep; grab bars: front transfer - 54 in ling, both sides, side transfer - 54 in on long side, 36 in length behind toilet; grab bar load limit: 300 lb; toilet bowl rim height: front transfer - 19 in, side transfer - 15-19 in; bowl center line: 18 in from wall; lavatories: 24 in deep, maximum height - 34 in with knee clearance of 29 1/2 in; provide single lever faucets, drain insulation; urinal: rim height - 16 in; space for wheelchair turn around: 60 in by 60 in
Water Fountains	Number: 1 per floor; provisions for front or side approach; maximum rim height: 34 in; minimum alcove width: 30 in
Public Telephones	Cord length: 32-36 in; maximum height to highest operable part: 48 in; minimum alcove width: 34 in; depth: 48 in
Elevators	Required in buildings of 2 or more floors; maximum level change: 1/4-1/2 in; cab dimensions: 68 in wide by 60 in deep; minimum clear door opening: 36 in, with 6-10 sec time delay closing; handrails required on 3 walls at 36 in high; control height: 30 in minimum to 54 in maximum, with emergency call box at 40 in maximum; provisions for arrival signals and raised control and jamb characters
Controls	Maximum height: 48 in; outlet height: 18 in minimum; operating force: less than 8 lb
Identification	International symbol of accessibility required at accessible facilities, functional areas and features; provisions for raised letters; mounting height: 40 in to 52 in from floor, 4 in to 16 in from latch side of door; provide textured warning strips at heads of stairs and ramps; visual indicators required in elevators and fire alarms; use flashing exit signs

B. Additions to the Scope of ANSI A117.1 (1961, R1971)

Curb Ramps; Drop-off, Pick-up Zones; Guard and Handrails; Trails; Assembly Seating Areas; Dining Areas; Shop and Craft Areas; Library and Office Areas; Locker Rooms, Showers, Pools; Vending Areas; Guesthouse Bedrooms

types have shifted the emphasis of accessibility criteria toward these specific building types, i.e. GSA focuses on office buildings whereas the Minimum Property Standards of HUD are addressed to the interior of residential buildings. It is also evident from the review that the various changes and additions by federal agencies to the ANSI A117.1 model are, principally, in the following areas: exterior circulation, interior circulation (entries, doorways, stairs, etc.), toilet rooms and bathrooms.

As far as the specific differences and variations to ANSI A117.1 are concerned, the federal agencies most often revise the ANSI A117.1 Standards to make them more prescriptive, i.e. substituting specific dimensions for performance-oriented criteria such as "appropriate number" or "within reach of persons in wheelchairs." The Veterans Administration makes special efforts toward relieving confusion between its specifications and those of ANSI A117.1 with the statement, "This VA construction standard shall govern wherever it deviates from ANSI A117.1 (1961)" (VA Construction Standard CD-28, 1973). HEW, in its technical handbook, in addition to noting specifications not covered by ANSI A117.1 but required by HEW and citing mental retardation as a disability, has tried to clarify the often ambiguous wording of standards by clearly stating the differences between "shall" (required) and "should" (highly recommended). The General Services Administration's guidelines, too, include both requirements and recommendations.

While the standards of the federal agencies are presented below, the common changes or additions made to ANSI A117.1 can be summarized as follows:

1. Statement of actual numbers of accessible facilities based on the specific responsibilities of various agencies.
2. Attention to specific details in design of the exterior path of travel.
3. Differing requirements for various slopes of walks and ramps.
4. Requirements for handrails on both sides of ramps and stairways.
5. Requirements of specific corridor and stairway width which are not dealt with explicitly in ANSI A117.1.
6. A multitude of dimensional requirements for accessibility to and usability of toilet facilities.

A major controversy among consumers, rehabilitation specialists and designers concerning the design of toilet stalls has been addressed by HEW, GSA and the VA with the inclusion of standards for toilet stalls that allow a side transfer as the preferred alternative to the conventional stall design prescribed by ANSI A117.1.

In 1966, HUD published PG 46, Minimum Property Standards, Housing for the Elderly (with special considerations for the handicapped). This document had numerous criteria for kitchens and bathrooms, but few that were concerned specifically with accessibility. In 1973, PG 46 was incorporated into the HUD Minimum Property Standards for single and multifamily housing. Until 1976, these standards were mostly concerned with public areas and did not treat residential living units in a comprehensive way. While accessible toilet stalls, water coolers and fire alarm systems were required, there were few requirements for specific conditions of accessibility in kitchen, bathroom, bedroom or living room design. The most recent revisions to the MPS, however, cover individual interior elements of the dwelling unit and cite either in-house standards or reference ANSI A117.1.

The terminology and inconsistency of the various regulations and guidelines leave much room for interpretation. In residential buildings, for example, HUD's MPS references ANSI A117.1 for placement of lavatories, yet ANSI A117.1 is ambiguous, stating: "Lavatories shall be usable by people in wheelchairs." The MPS does, however, cite dimensional requirements for bathtub and shower sizes.

Since the passage of the Architectural Barriers Act of 1968, more than 3,000 buildings have been constructed under the jurisdiction of the law (AIA-Iowa Chapter, 1974). Unfortunately, not all of these have proved accessible to handicapped people. A survey of 34 federally funded buildings in Iowa, built since the passage of Public Law 90-480, conducted by the Iowa Chapter of the American Institute of Architects, found buildings that were in direct violation of the law. In one case, for example, bathrooms that were in total compliance with ANSI A117.1 were situated on the second floor, and could be reached only by stairs or a key-operated elevator. In 70 percent of the buildings surveyed, parking facilities for the handicapped were found to be inadequate. Additional findings by Robert Harris, at the University of Kansas, and architectural trainees of the General Services Administration (GSA, 1971), confirmed the Iowa study. In 1975, the General Accounting Office reported to congress that not one of 314 randomly selected federally funded buildings built since 1970 was completely barrier free. Restroom layouts, parking design, control location, elevators and building identification were generally difficient in terms of design for disabled people. The study concluded that legislative changes were needed to provide for:

1. Barrier-free, federally leased buildings;
2. Clear mandates to GSA, DOD, HEW and HUD to provide accessibility standards applicable to their particular type of construction; and
3. Continuing survey and compliance investigations.

Indeed, many facilities constructed under the jurisdiction of Public Law 90-480 have fallen short of the accessibility goal: "To insure that

Enforcement of such a law as Public Law 90-480 is not simple; but generally, two main goals emerge:

1. A resolution or national policy deciding the degree of disability for which buildings should be designed is necessary to develop standards for accessibility and mechanisms for fair enforcement of regulations.
2. Once the target user population is decided, the future development of standards should avoid ambiguous wording and requirements subject to multiple interpretations by vague wording or implications.

To reach these goals, the consensus of consumers, designers and builders is necessary from the initial development of the actual standards to their use in regulations.

There are efforts underway to increase the role of the federal government in implementing barrier-free environments. The Rehabilitation Act of 1973 (as amended in 1974), for example Public Law 93-112, not only authorized the evaluation and expansion of employment, medical and educational opportunities for disabled people, but established the Architectural and Transportation Barriers Compliance Board. Two missions of the Board include the insured compliance of barrier-free standards pursuant to Public Law 90-480, and the recommendations of measures to the federal government necessary for the elimination of environmental barriers. Section 503 of the Rehabilitation Act requires that contractors doing federal business in excess of $2,500 annually cannot deny employment to disabled people because of architectural barriers; Section 504 requires that newly constructed or renovated buildings, providing federally funded services to the public, must provide access to disabled people.

Model Building Codes

In addition to the surveys of state and federal building standards and regulations, provisions of the four national model code organizations were reviewed. These organizations are: International Conference of Building Officials (ICBO), responsible for the Uniform Building Code, the Building Officials Code Administrators International (BOCA), producing the BOCA Basic Building Code, the Southern Building Code Congress, issuing the Southern Standard Building Code, and the American Insurance Association, responsible for the National Building Code.

An analysis of the accessibility provisions in these codes is presented below. The Uniform Building Code, BOCA and Southern Standard Building Code each have specific chapters related to barrier-free design. The National Building Code has no specific handicapped section but references ANSI A117.1

The most noteworthy differences between ANSI A117.1 and the model codes

share similar requirements for ramps and stairs, different from ANSI A117.1. Again, these differences often take the form of application of specific dimensions or further articulation of ANSI A117.1 performance-type criteria. Many ANSI A117.1 provisions are noticably absent from the Uniform and Southern Codes, particularly, the provisions concerning site development, but Southern does give a table for determining the number of accessible parking spaces. Both the Uniform and Southern Codes list building types and occupancies where egress for disabled persons (ramps or elevators) is required. Southern and BOCA break from ANSI A117.1 and allow telephones to be placed at a height of 54 inches to the coin slot.

State Codes

Using compendiums supplied by the Subcommittee on Barrier-Free Design of the President's Committee on Employment of the Handicapped, The National Center for Law and the Handicapped, and the Michigan Center for a Barrier-Free Environment, and direct information sent upon request from the states, applicable legislation and standards for accessibility in all 50 states and the District of Columbia was identified. In addition, the scope, prevalence of adoption of ANSI A117.1, additions and changes to it, the mechanism for enforcement and the mechanism on the part of each state for review changes of regulations were analyzed (see Table 5).

All states and the District of Columbia have either directly quoted ANSI A117.1, in whole or in part, or used it as a basis for the promulgation additional or substitute standards, or indirectly as a model. Several states adopting ANSI have deleted single or multiple sections of it. While all states have some form of legislation concerning environmental barriers, the scope and mechanisms for enforcement and review vary considerably.

The findings reveal that like the federal agencies, many states have chosen to articulate elements covered by ANSI A117.1, often changing qualitative criteria to specific quantitative and prescriptive criteria. Many states have extended the scope of building elements noticably for institutional building types and in the definition of improved areas to include accessible paths of travel outside buildings. Generally, there are few relationships among states within geographical areas, with the exception of the Midwest in which the states tend to have similar scopes.

While all 50 states and the District of Columbia require newly constructed, publicly funded buildings to be accessible, only 30 extend accessibility requirements to remodeling, additions, or alterations. Application of accessibility regulations to an existing building will often be subject to percentage formulas regarding the portion renovated either in terms of square footage or assessed valuation. Usually, if the renovation work exceeds 50 percent of the existing square footage

Table 4.A: Model Codes - BOCA (1975)

Differences from ANSI A117.1 (1961, R1971)	
Walks	Width: 5 ft - 0 in; slope: 1:20 maximum
Parking Facilities	Number of accessible spaces according to chart of total spaces: "as cl[illegible] as possible" to elevators, ramps, walks and entrances (Special Handica[illegible] Section)
Elevators	Minimum area: 25 sq ft; minimum dimensions: 56 in; door width: 32 in m[illegible] mum; call buttons; braille plate 60 in high maximum; braille plate at floor door jamb (Special Handicapped Section)
Toilets and Lavatories	1 toilet room and stall accessible; minimum area at entrance: 60 in x [illegible] in; 48 in between water closet and stall door; 72 in deep; 42 in wide; [illegible] in; door swings out; grab bars 33 in high; 42 in long; 17 in seat; chil[illegible] handrails 28 in
Special Spaces and Requirements	Provisions for accessible residential units (1:25 accessible); assembl[illegible] seats according to table; 36 in checkout lanes; alternate route with n[illegible] turnstile (Special Handicapped Section)
Water Fountains	5% or no less than 1; 30 in maximum height; fully recessed not accepta[illegible] (Special Handicapped Section)
Public Telephones	5% or no less than 1; all usable parts no higher than 54 in (Special H[illegible] capped Section)

Table 4.B: Model Codes - Southern Building Code (1975)

Differences from ANSI A117.1 (1961, R1971)	
Parking Facilities	Number of handicapped spaces as per table; location should be as clos possible to accessible entrance (Special Handicapped Section)
Ramps	Maximum slope: 1:12 (Special Handicapped Section)
Corridors	Minimum width: 44 in, 36 in in residences if no side openings (Specia Handicapped Section)
Doors	Entrances: 32 in minimum clear width opening; other: 29 in minimum cl width opening (Special Handicapped Section)
Toilets and Lavatories	One accessible toilet room per sex per floor; 4 ft x 5 ft access spac required where vestibule screens used, where this space is not provid doors must swing out (Special Handicapped Section)
Elevators	Floor buttons: 1/2 in high and 0.025 in thick raised letters with bra floor designated on jambs as above with 1.5 in characher and braille Handicapped Section)
Water Fountains	Spout height: 33 in; alcove width: 32 in (minimum) (Special Handicapp Section)
Public Telephones	Highest operable part: 54 in; 30 in wide access space (Special Handic Section)

Table 4.C: Model Codes - Uniform Building Code

Differences from ANSI A117.1 (1961, R1971)	
Ramps	Width: 44 in; slope: 1:10 (maximum for egress); others: 1:8 allowable rails required for slopes greater than 1:15
Entrances	Contains chart showing required situations for egress by means of ram elevator for physically handicapped (Special Handicapped Section)
Doors and Doorways	No revolving, sliding or overhead doors as major exits; doors: 3 ft - wide required for exit; minimum clear opening: 2 ft - 4 in
Corridors	Width: 44 in
Stairs	Width: 44 in (minimum - increased as occupancy load increases); handr both sides 30 in to 40 in; 6 in extension (minimum) top and bottom
Toilets and Lavatories	32 in clear space in front of bowl; unobstructed clear space at lavat 26 in wide x 24 in high x 12 in deep
Water Fountains	Hand operated only; 33 in high; alcove 32 in wide
Public Telephones	All usable parts 48 in high (maximum); unobstructed access within 12 in wide; 32 in deep
Identification	Exit doors and markings on glass doors

.D: Model Codes - National Building Code (1976)

nces from ANSI A117.1 (1961, R1971)	
	Maximum slope: 1:10; 36 in width (minimum); handrails 30 in to 34 in high
nd Doorways	Door opening force not to exceed 50 lb; minimum clear width: 28 in
rs	No less than 36 in wide
	Minimum width: 44 in; maximum riser height: 8 in; minimum tread width: 9 in (exclusive of nosing)

Scope												Enforcement							Standard						Commentary
New	Remodeled	Publicly Funded	Privately Funded:	Mercantile	Business	Educational	Industrial	Residential (Hotel) Accommodations	Institutional	Assembly	Residential (Multi-Family)	Building Code Council	Barrier-Free Design Board	State Funding Agency	Local Municipality	Dept. of Public Works	State Fire Marshall	Other	ANSI Reference	State Code	Model Building Code	Other	Effective Date	Legislative Reference (State Statute)	
								X															1/76	50:16(4) - 50:16(13)	
X		X													X	X			X	X			1972	35.10.015	If local codes have no har section, state standards c apply.
X		X												X						X			1973	34-411	
X		X																					1967	14-627	
X	X	X	X	X[1]	X			X	X	X	X[2]			X							X[2]		1974	19955-19959	
X		X													X	X			X				1975	9-5-101	
X	X	X	X	X	X	X	X[3]	X	X	X	X	X							X				1975	75-503	
X	X	X												X					X				1973	29:6917	
X		X																	X				1968	42-4151-4156	
X	X	X	X	X	X	X	X	X	X	X	X								X	X		X[4]	1975	553.45 - 553.48	
X	X	X															X		X				1972	91-1104 - 91-1125	
X		X												X					X				1965	103-50	

Table 5: State Review, contintued

	Scope												Enforcement							Standard						Commentary
	New	Remodeled	Publicly Funded	Privately Funded:	Mercantile	Business	Educational	Industrial	Residential (Hotel) Accommodations	Institutional	Assembly	Residential (Multi-Family)	Building Code Council	Barrier-Free Design Board	State Funding Agency	Local Municipality	Dept. of Public Works	State Fire Marshall	Other	ANSI Reference	State Code	Model Building Code	Other	Effective Date	Legislative Reference (State Statute)	
	X		X																	X				1974	39-3201 - 39-3210	
	X	X	X	X[5]	X	X	X	X	X	X	X				X				X[6]		X[7]			10/75	79-978	15,000 sq ft or less on n level floors, only 1st fl be accessible unless publ owned
	X		X										X							X				12/74	(20-421)-1 to (20-421)-32	
	X	X	X	X	X	X	X	X	X	X	X	X[8]			X	X				X	X			1/75	104A.1 - 104A.6	
	X		X												X	X				X			X[9]			
	X		X															X		X				6/74	227.305	
	X	X	X															X		X				7/66	49:148 - 49: 148.3	
	X	X	X						X			X[10]			X	X			X[11]	X				3/75	25:2701 - 25: 2705	
	X		X	?[12]											X	X				X						
s	X	X[13]	X	X	X	X	X	X	X	X	X	X[14]		X							X			1974	22:13A	

State Review, continued

	Scope												Enforcement							Standard						Commentary
	New	Remodeled	Publicly Funded	Privately Funded:	Mercantile	Business	Educational	Industrial	Residential (Hotel) Accommodations	Institutional	Assembly	Residential (Multi-Family)	Building Code Council	Barrier-Free Design Board	State Funding Agency	Local Municipality	Dept. of Public Works	State Fire Marshall	Other	ANSI Reference	State Code	Model Building Code	Other	Effective Date	Legislative Reference (State Statute)	
	X	X[15]	X	X	X	X	X	X	X	X	X	X	X	X							X			1974	125.1502 - 125.1530	
	X	X	X	X	X	X	X	X	X	X	X	X				X		X			X			1974	471.465	
i	X		X	X[16]							X								X[17]	X			X	1972	43-6-101	
	X		X												X						X			1975	SB #217	
	X		X										X								X			1974	69-2105	
	X	X	X	X[18]	X	X	X	X	X	X	X								X[19]	X				1975	72-1101	
	X		X										Not included in statute							X				1973	338:180	
ire	X		X												X	X				X				1975	155-A:1	
	X	X[20]	X	X	X	X	X	X[21]	X	X	X	X[22]				X			X[23]		X			1975	52:32-4	
	X		X												X				X				X	1973	67-35-1	
	X	X	X										X								X			1974	Public Building Law Sec. 50-52	
lina	X	X	X	X	X	X	X	X	X	X	X	X	X						X[24]		X			1973	143-138	
ta	X	X	X	X[25]	X	X	X	X	X	X	X								X[26]	X			X	1975	48-02-19	
	X		X	X									X								X			1974	3781.03	

: State Review, continued

	Scope: New	Remodeled	Publicly Funded	Privately Funded:	Mercantile	Business	Educational	Industrial	Residential (Hotel) Accommodations	Institutional	Assembly	Residential (Multi-Family)	Enforcement: Building Code Council	Barrier-Free Design Board	State Funding Agency	Local Municipality	Dept. of Public Works	State Fire Marshall	Other	Standard: ANSI Reference	State Code	Model Building Code	Other	Effective Date	Legislative Reference (State Statute)	Commentary
a	X	X[27]	X										X		X					X				1973	61.11	
	X	X	X	X	X	X	X	X	X	X	X								X[28]		X			1975	539HB2308	
vania	X		X	X	X						X								X[29]	X				1974	71:1455.1	
sland	X	X	X	X	X[30]	X	X	X	X	X	X[31]				X	X				X				1975	37-17-1	
Carolina	X	X[32]	X	X	X	X	X	X	X	X	X	X[33]		X						X		X		1975	1-491	
Dakota	X	X	X												X	X				X				1975	5-14-12	
see	X	X	X	X	X	X	X	X	X	X	X				X	X				X				1974	53-2544	
	X	X	X																X		X			1975	6789	Refers to Standards ment by State Bldg.
	X	X[34]	X										X								X			1977		
	X		X												X	X				X				1974	T18:1305a	
a	X	X	X												X	X							X	1972	2.1 - 109.02	Div. of Engineering state level, county standards
ton	X	X		X	X	X	X	X	X	X	X	X	X							X	X			1973	70.92A.010	"Gathering" on amuse

tate Review, continued

	Scope												Enforcement							Standard						Commentary
	New	Remodeled	Publicly Funded	Privately Funded:	Mercantile	Business	Educational	Industrial	Residential (Hotel) Accommodations	Institutional	Assembly	Residential (Multi-Family)	Building Code Council	Barrier-Free Design Board	State Funding Agency	Local Municipality	Dept. of Public Works	State Fire Marshall	Other	ANSI Reference	State Code	Model Building Code	Other	Effective Date	Legislative Reference (State Statute)	
ia	X		X	X	X	X	X	X[35]	X	X[36]	X	X[37]							X[38]		X			1974	1810F-1	
	X	X[34]	X	X	X	X	X	X[35]	X	X[36]	X	X[37]							X[39]	X				1974	101.13	
	X	X	X													X		X		X[40]				1975	35-503	

Table 5: <u>State Review - Footnotes</u>

1. Restaurants only
2. U.B.C. - ICBO
3. Storage, high hazard excluded
4. Department of Community Affairs
5. Square footage waiver
6. Department of Law Enforcement
7. Capital Development Board
8. 10% of units or 1 in units equal to or more than 5 units (publicly funded only)
9. Subject to modification by State Department of Administration, Statewide Building Code being promulgated
10. State financed
11. State financed housing in excess of 20 units
12. Unclear
13. Scope based on remodeling cost as percent of assessed valuation
14. 5% of units in structures with 20 units or more
15. Scope based on remodeling as percent of total building area
16. Independent communities empowered by state to adopted codes, one concern of which is ingress and egress
17. State Board of Health
18. Where public is business invitee
19. Public Building Safety Advisory Committee
20. Scope depends on remodeling cost as percent of assessed valuation
21. Warehouse and hazardous occupancies exempted
22. 1 to 4 family structures exempted
23. Division of Building and Construction
24. Department of Insurance
25. Toilet rooms only
26. State Construction Superintendent
27. Scope depends on square footage as portion of existing, also omits elevators from standards
28. Director of Commerce
29. Department of Labor and Industry
30. Exceeding 2 stories or employing more than 40 people
31. Applicable only to occupancies exceeding 150 people
32. 35% of building changed
33. 5% or 1 or 20 units or more
34. If more than 50% of total building; if less than 25% only parts remodeled
35. Hazardous occupancy and warehouse exempted
36. Jails, convents, etc. exempted
37. Apartments with less than 20 units exempted
38. Director of Vocational Rehabilitation
39. Department of Administration
40. Elevator Standards

that is required by law in the private sector of the economy. Twenty-two states, usually those with state building codes, extend accessibility requirements to the private sector but only thirteen of these have provisions for accessible housing. None of the thirteen require accessible dwelling units in buildings with less than five dwelling units, and most limit the provision of accessible dwelling units to buildings with twenty units or more.

At least three states: Massachusetts, Michigan and South Carolina have barrier-free design boards responsible for standards' review and enforcement. The barrier-free design boards are composed of members of many interest groups, including architects, consumers, builders and social service agencies. The boards seem to be effective and realistic in settling disputes over waivers. The legislation of all states allows for granting waivers. While the regulations of many states limit application of codes to publicly funded buildings, several states (of which North Carolina and Utah are good examples) have published extensive illustrated versions of the state codes, including chapters on recommended accessibility features for residential design.

The standards promulgated by states are constantly changing. State legislation has come in phases, from the adoption of ANSI A117.1 by many states in the mid 1960s to the inclusion of privately funded, publicy used buildings, to the inclusion of residential structures. Recent federal legislation and regulations will undoubtedly have a dramatic effect on state legislation and building standards in the future.

Many state development authorities and corporations who grant construction loans were contacted requesting any applicable construction standards for residential facilities. Nine out of 11 responded to this request. Most of these organizations leave accessibility requirements for housing projects for consideration as part of the program of individual projects. It was also discovered that separate state agencies such as housing authorities and university systems within each state often have the power to, and do, issue more extensive standards than appear in state legislation and regulations.

City Codes and Ordinances

Originally, the review of codes and ordinances of cities was to be based on a geographical cross section of cities in the United States in three population categories: large (over 1 million), medium (250-750 thousand) and small (under 250 thousand). Problems in data collection became evident as requests to building and code departments were repeatedly ignored. With the cooperation of the New York City Mayor's Office for the Handicapped, information regarding ordinances for accessibility in several cities was obtained.

Of the cities surveyed, only three had adopted ordinances on accessibility with variations to ANSI: New York, South Bend, IN and Rochester, NY. We found that other cities either adopted one of the national

tained requirements for access solely in state or municipally operated facilities.

International Codes and Standards

The International Centre on Technical Aids, Housing and Transportation (ICTA) developed a report entitled, "Norms Concerning the Accessibility for Disabled Persons to Buildings and Environments in Different Countries," which includes a review of eight major considerations for accessible buildings in 17 nations. Althouth letters were sent to building agencies in many of these countries, only a few sets of regulations were obtained. The eight building elements included in the ICTA survey are: width of walk, corridor width, clear width of doors, toilet stall and elevator dimensions, parking space width, ramp slope and height of controls.

Western European nations seem to have the most complete requirements and are more prescriptive than ANSI A117.1. While virtually all nations specify corridor widths and elevator sizes, ANSI A117.1 uses a performance "general principle" to determine corridor width. Where ANSI does specify specific dimensional requirements, there appears to be general consensus among these countries and the ANSI Standard in clear width of doors, ramp slope and walk width. Toilet stall sizes range from the largest with 71 inches by 110 inches for Canada, to the smallest of 36 inches by 56 inches as specified by ANSI A117.1. The only area where the ANSI A117.1 dimension exceeds the criteria of other nations is the parking space width, due of course to the larger sized American cars.

Summary

This report has examined the codes, standards and regulations of state and federal agencies, cities, national building codes and other Western nations regarding design for accessibility and usability of buildings by disabled people. ANSI A117.1, "Making Buildings and Facilities Accessible to and Usable by the Physically Handicapped" was used as a baseline for review. This enabled an identification of general consensus and problem areas. Existing procedures for enforcement have also been reviewed

From this review, the major problems associated with design standards and regulations for accessibility and their enforcement can be summarized as follows:

1. There has not been a conclusive, explicit policy regarding the target user population for standards.
2. Ambiguous wording in standards is a continuing problem.
3. Reliance on very general performance-oriented criteria has not been successful.
4. There has been little attention to buildings other than publicly used buildings in design criteria.
5. There is inadequate base treatment of the selection and location of building products such as hardware and plumbing fixtures.

6. Codes and other regulations have not been fully implemented and enforced.
7. Inadequacies and inconsistencies among model standards have led to lack of uniformity and a proliferation of local, regional and agency differences.

Recent efforts by state governments and the federal government have sought to resolve some of the problems associated with design standards. Many states have extended the scope of barrier-free legislation to include privately funded, publicly used buildings and facilities and a few have extended the scope to residential buildings. The role of the federal government has been extended with the creation of the Architectural and Transportation Barriers Compliance Board and the provisions of Section 503 and 504 of the Rehabilitation Act of 1973, as amended. These will be major factors in the evolution of national policy in barrier-free design.

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The Scope of Barrier-Free Design

5

Introduction

Most guidelines and manuals on barrier-free design focus on accessibility for the wheelchair user as the "common denominator" for design. It is assumed that, if buildings and facilities are made accessible to people who use wheelchairs, then people with other disabilities will be able to gain access and use as well. This assumption is not founded in fact. Actually, a few barrier-free features, if designed solely for accessability by wheelchair users, can be hazardous and unusable by others. For example, elimination of curbs, while good for wheelchair users, may, under certain conditions be dangerous to blind people. Also, people with other disabilities have many needs that are not satisfied by designs accommodating wheelchair users alone.

In guidelines and manuals, little attention is given to problem identification and analysis. Thus, there is great variation in the scope of recommendations. Such sources are basically a collection of design recommendations on a variety of subjects that the author feels are important. Readers have great difficulty in separating those recommendations that are a must for access and use from those that provide additional convenience in use. Moreover, it is difficult, because the emphasis in such sources is usually on wheelchair use, to identify the relative impact of design criteria on people with various types of disabilties.

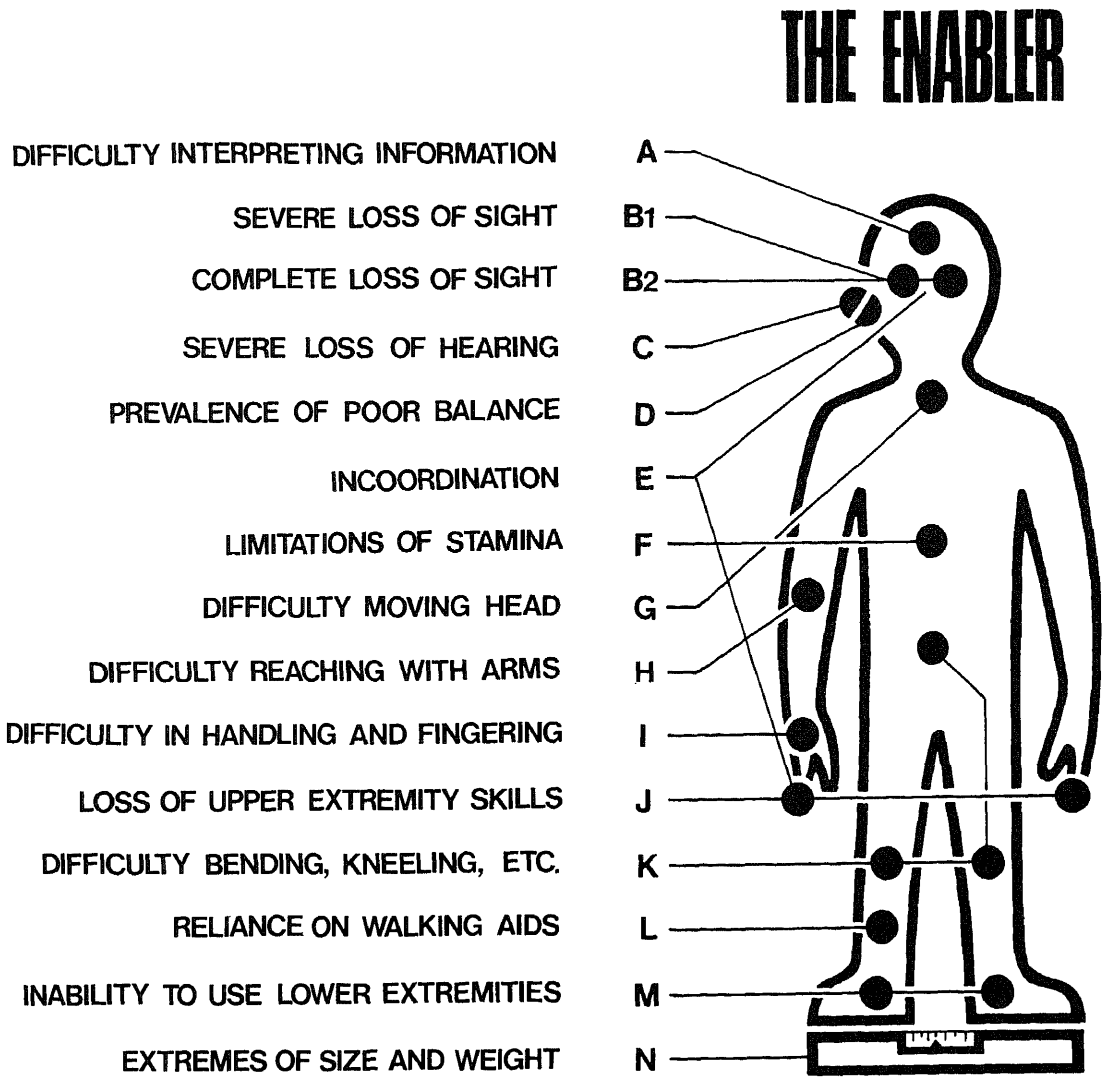
To eliminate preconceptions caused by a reductionist view of the disabled population, a more accurate image must replace the wheelchair user. This image must be easy to conceptualize in terms of building design and must integrate all the relevant disabilities in a simplified way. All relevant disabilities must be easily visualized so that a designer, researcher or building evaluator can picture, in their mind, who it is that accessibility is meant to help. Furthermore, a problem analysis that focuses on the identification of design issues in access and an evaluation of the impact barriers have on people with various disabilities would help to put specific accessibility concerns in context and identify priorities for attention through regulations and design action.

This section presents an integrated image of the disabled population in the form of an ideogram called the Enabler, and an analysis that summarized the major issues of access to buildings and facilities in the form of problem identification matrices.

The Enabler

The Enabler (Fig. 1) represents a person's abilities as a basis for design. It illustrates the fifteen different disability concerns that should be considered in design. They are presented in logical order, from top to bottom, as concerns of:

Figure 1: The Enabler



3. Internal body regulation,
4. Motor impairment.

Included are observable impairments such as inability to use lower extremities (wheelchair users) as well as "invisible" disabilities, such as limitations of stamina and loss of hearing.

The Enabler can be useful as a conceptualization aid and as an empathic image to help the designer or researcher in making a more personal identification with the building/facility user.

Problem Identification Matrices

The following matrices (Fig. 2A to 2M) were developed by analyzing building and site elements for physical conditions that have an impact on access and use for people with one or more of the disabilities identified by the Enabler. This analysis was completed by a review of empirical research, design manuals, discussions with other researchers and disabled people, and professional judgment.

The conditions listed may be problems to all users of buildings and facilities, even if they have no disabilities. However, for each condition, some disabled people have more difficulty coping than do able-bodied people. The matrices are composed by juxtaposing the physical conditions against the Enabler. Intersections are coded as: 1) potential problem, 2) problem, 3) severe problem, and 4) impossibility. No code at an intersection means that a person with the designated disability would have no greater problem with the specific physical condition than an able-bodied person would have.

The matrices provide much insight into the extent and nature of accessibility problems. First, the lists of conditions show the specific nature and pervasiveness of accessibility concerns. They include all aspects of experiencing the environment and range in scale from the layout of circulation paths on a site to the size of an elevator control button. Second, they indicate that all design disciplines must be concerned about accessibility-- the landscape architect, architect, interior designer and industrial designer. Third, it can be observed that the concerns of accessibility are not different than typical design concerns. However, the design of many items often taken for granted must be given more detailed attention by designers when use by disabled people is considered. Fourth, the matrices show that, although the greatest impact of the environment is on those people who cannot use their legs (wheelchair users), there are a large number of problems that have greater impact upon people with severe loss of vision and blindness. People with other disabilities such as poor balance, low stamina, incoordination and use of walking aids experience an impact almost as pervasive as those with inability to use their legs, however, the intensity of impact is generally less severe. The impact on difficulties in reaching, using arms, and in handling and fingering is restricted to

those parts of the environment that have to be manipulated or touched; but there, the degree of problems is greater. There is very little impact upon those people who have severe hearing loss. The greatest impact on access and use would clearly be upon those people with multiple disabilities affecting use of legs and also arms, hands or fingers.

There are many physical conditions that present severe problems to access and use but do not prohibit access and use, although the quality of experience under such conditions may suffer in comparison to a more accessible environment. Some serious safety hazards may also exist with such conditions. There are also many conditions which are potentially a problem or impossibility, depending on the idiosyncrasies of an individual's disability.

There are some limitations in using these matrices to identify priorities:

1. Since no evaluation is made on the importance of each physical condition for access and use of buildings and facilities, the existence of an impossibility refers only to that condition, not the use of a building or facility as a whole.
2. Where a physical condition is a problem for two or more different disabilities, one cannot conclude that each has the same problem.
3. Many of the problems may not be critical if alternative ways to gain access and use of a building are available.

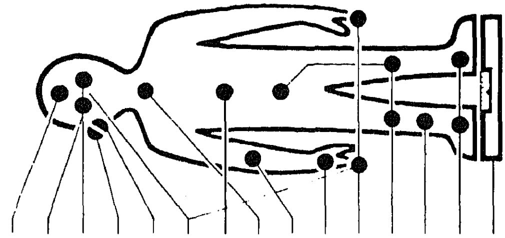
Thus, the use of these matrices, in terms of setting priorities, is limited to the evaluation of impact upon the disabled population. Clearly, some observations can be made in this regard:

1. The removal of conditions that restrict use by wheelchair users will often significantly improve the accessibility and usability of buildings for people with poor balance, stamina limitations and reliance on walking aids as well.
2. The removal of conditions that cause problems in access and use of buildings by blind and partially sighted people should receive high priority attention in view of the extent of such problems.
3. The removal of conditions that cause problems for people with limitations in reaching, use of arms and handling and fingering should receive priority attention in view of the many impossibilities resulting from such conditions.

A careful review of the matrices will identify some paradoxes. For example, deaf people cannot hear signals, but blind people cannot see them. Table 1 identifies major conflicts and presents recommended solutions. Except for the provision of hand and foot controls together

Figure 2.A: Problem Identification Matrix

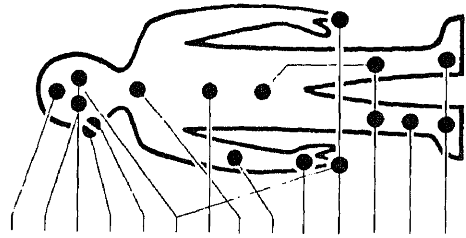
- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility



Outdoor Circulation Paths

Outdoor Circulation Paths	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Narrow paths					◯	◯							◯	◯	•
2. Irregular walking surface		○	◯		•	•		◯					◯	◯	
3. Unstable walking surfaces (e.g. loose dirt)		○	◯		◯	◯	○						◯	●	
4. Path surfaces that are not level		○	◯		◯	◯	○						◯	◯	
5. Paths with steep grades		○	◯		○	○	◯						◯	◯	•
6. Routes with stairs		○	◯		◯	◯	◯	•				•	◯	●	•
7. No tactile cues of abrupt level changes or other hazardous areas		○	◯												
8. High curbs		•	•		◯	◯	◯	•					◯	●	○
9. No protection against puddle formation, leaf & litter accumulation		◯	◯				•						◯	○	
10. Poorly drained paths & roadways		○	○		◯	○	•	○					◯	◯	
11. No protection from wet & icy weather conditions		○	◯		•	•	◯						◯	◯	•
12. No place to hold onto for balance along steep grades		•	•		●	◯	●						•		•
13. No place to rest on long traverses					◯	◯	●						◯	○	○
14. Poor lighting on circulation paths	•	○		◯	○			•					◯	◯	•
15. Complicated routes from site access points to building entries		•	◯				•						•	•	
16. Lack of nonvisual maps for building complexes or campuses			◯												
17. Very low level of illumination on walking surface		●													

Figure 2.B: Problem Identification Matrix

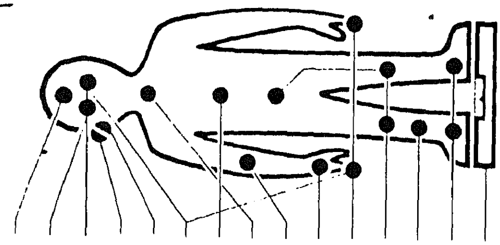


- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility

Parking

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M
1. Narrow parking space or no transfer space next to parking space					•	•							●	●
2. Parking spaces located far from building entrances	●				•	•	●						•	•
3. Passenger loading zones located far from building entrances		◯	◯				●						•	•
4. Inadequate shelter from weather when leaving a car & entering a building					•	•	◯						◯	◯
5. Rough or unstable walking surfaces in lots		•	•		◯	◯	◯	●					◯	◯
6. Confusing layouts in garages & lots	◯													
7. Directions poorly marked	◯							◯						
8. Spaces reserved for disabled people poorly marked	◯							◯					◯	◯
9. Path from parking spaces reserved for disabled people to building entrances requires crossing vehicular traffic	◯				•	•								•

Figure 2.C: Problem Indentification Matrix



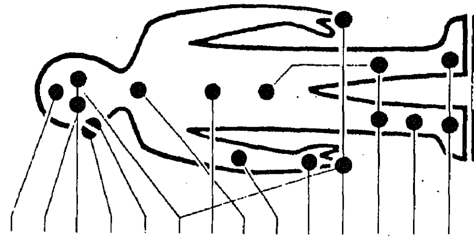
- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility

Curb Ramps and Intersections

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Curbs without ramps where walks intersect streets					◯	◯	◯						◯	◯	
2. Curb ramps located where pedestrians have to walk across them		◯	◯		◯	◯		•					•	◯	
3. Curb ramps with abrupt sides		◯	◯		◯	◯		•					•	•	
4. Curb ramp configurations that require waiting at the bottom of the ramp before crossing street													•	◯	
5. Curb ramps located outside marked cross walks at intersections or in places that guide people into traffic	•	◯	◯												
6. Steep gradients					◯	◯	◯							◯	
7. Paved paths without curbs or other tactile edges where they intersect or bound vehicular paths		◯	●												
8. Short time periods for pedestrian crossing intervals on traffic signals		◯	◯				●						◯	◯	

Figure 2.D: Problem Identification Matrix

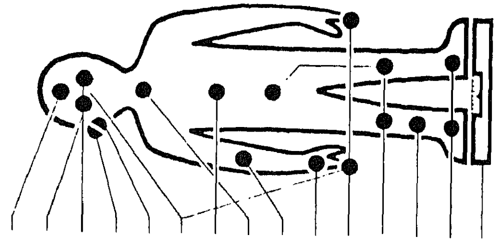
• potential problem
○ problem
◯ severe problem
● impossibility



Built-In Landscape Furniture

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M
1. Very low, high or narrow seating surfaces					◯	◯	◯					◯	◯	◯
2. Seating and other items used by people located on rough ground					◯	◯	•						◯	◯
3. Space next to benches not large enough to maneuver wheelchairs or walking aids														●
4. No space clearances at side or under tables to maneuver wheelchairs or walking aids													◯	●
5. Seating not oriented toward important objects of view	•						◯							
6. Landscape furniture placed in path of travel		◯	◯										◯	◯
7. Receptacles, dispensers and telephones located at extremes of reach					◯	○	•		◯	◯	●		◯	●
8. Obstructions to maneuvering close to or under receptacles, dispensers, telephones and water fountains													◯	●
9. Overhanging objects	•	◯	●											

Figure 2.E: Problem Identification Matrix



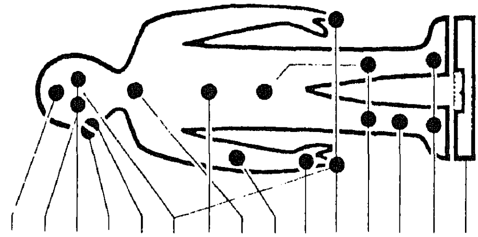
- • potential problem
- o problem
- ◯ severe problem
- ● impossibility

Entrances, Exits and Doorways

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Extremely narrow door openings													●	●	•
2. High thresholds or stairs at entrance/exit		◯	◯		◯	◯		•					◯	●	
3. Not enough maneuvering space in front of doors													◯	●	•
4. Door swings that partially obstruct use													•	●	•
5. No level space in front of entry doors													◯	◯	
6. Directions unclear or poorly marked	◯	◯	◯				•						•	•	•
7. Illogical opening procedure	●	•	◯			◯									
8. Great force needed to open doors					◯	◯	◯		◯		●		◯	◯	•
9. Stairs in path of travel to an emergency exit or place of refuge		•	•										◯	●	
10. Revolving doors on turnstiles		o	o										●	●	

Figure 2.F: Problem Identification Matrix

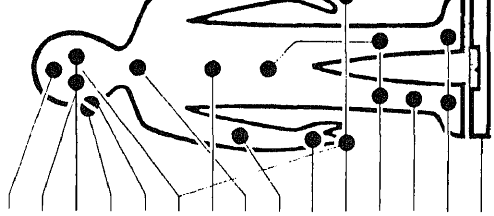
- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility



Interior Circulation Paths

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Stairs or high thresholds on paths of travel to rooms or spaces		◯	◯		◯	◯		•					◯	●	
2. Complex or confusing circulation paths	◯	◯	◯				●						•	•	
3. Amenities (e.g. water fountains) located along paths of travel that have level changes or are extremely narrow	•	◯	●				◯						◯	●	
4. Indirect and inefficient circulation paths	•	◯	◯				◯						○	○	
5. Extremely narrow passageways & corridors													◯	●	•
6. Long circulation paths without supports for balance or places to rest					◯	◯	●						◯	◯	
7. No tactile cues to direction changes or intersections		•	◯												
8. Inconsistent room numbering	◯	◯	●				◯						•	•	
9. Slippery walking surfaces		◯	◯		◯	◯	•						◯		•
10. Walking surfaces with steep inclines		○	○		◯		◯	•					◯	◯	
11. Carpet with high pile, loose weave or soft underlayment							•						•	◯	
12. Lack of information sources (e.g. receptionist to give directions at main entrance)	◯	•	◯												
13. Random placement of furniture, plants, fountains, etc. in circulation areas		◯	◯		◯	◯	•						•	•	

- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility



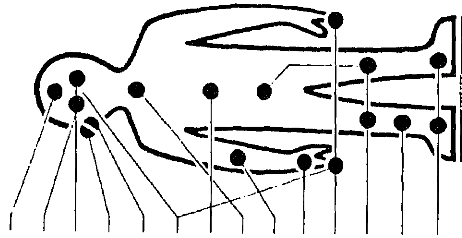
Interior Circulation Paths, continued

15. Lack of audio or tactile orientation cues for crossing large open spaces
16. Seating areas that can only be reached by stairs

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
15.			◯												
16.					•		•						◯	●	

Figure 2.G: Problem Identification Matrix

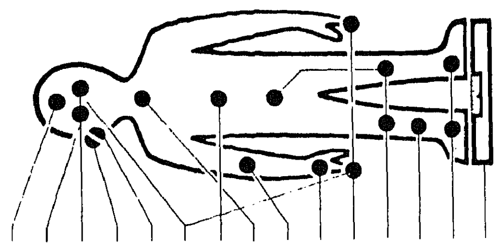
- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility



	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M
Vertical Circulation														
Stairs														
1. Stair treads with narrow depth or irregular depths	◯	◯	◯		◯	◯	◯						◯	
2. Very high, very low or irregular heights of risers		◯	◯		◯	◯	◯						◯	
3. Step profiles with abrupt projecting nosing													◯	
4. No railings or handrail extensions	•	•	•		◯	◯	◯						●	
5. Railing too high or too low					◯	◯	◯						●	
6. Stairs leading directly off a circulation path with no setback		◯	◯		•	•	•						•	
7. No tactile cues to stiarway in circulation path		◯	●											
8. Visual environment that distracts stairway user's attention from stairs		◯												
9. Visual pattern on stair treads that camoflages edge of treads	•	◯												
10. Low illumination level on walking surface or railings		●												
Ramps														
1. Steep gradients					◯	◯	◯						◯	◯
2. Very long runs					◯	◯	◯						◯	◯
3. Slippery surface					◯	◯							◯	◯
4. Carpeted surface with loose weave, high pile, or soft underlayment														◯

Figure 2.G: continued

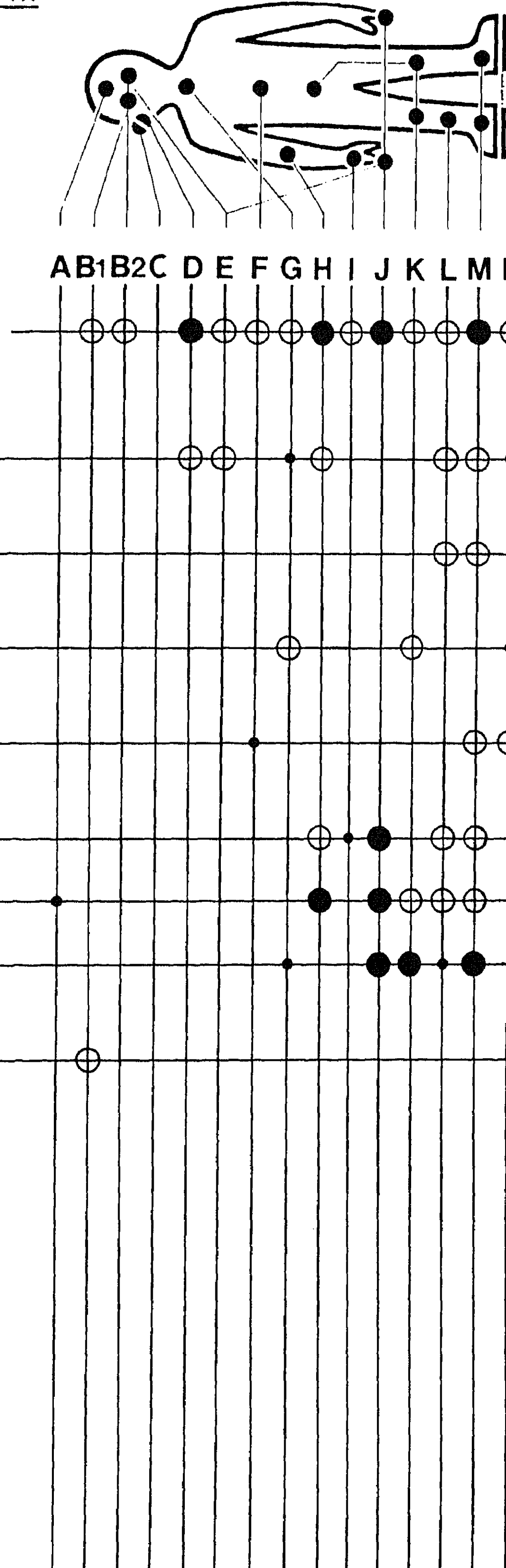
• potential problem
○ problem
◯ severe problem
● impossibility



	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
Ramps, continued															
5. No railings					◯	◯	◯						◯	◯	
6. No protection against slipping off sides of ramps		◯	◯										◯	◯	
7. Very high or very low railings					◯	◯	◯						◯		
Mechanical Transport															
1. Elevator car floor not flush with building floor		◯	◯		◯	◯		◯					◯	◯	
2. Wide gap between elevator floor & building floor	•	◯	◯		○	◯		◯					◯	◯	
3. No automatic feature that reopens doors without contact with individual	○	◯	●		◯	◯	◯						◯	◯	•
4. Confusing organization of controls	◯	◯	◯												
5. No handrail in elevator car					•	•	•						•		
6. Elevators that stop abruptly					•	•							•		
7. Elevators with small interior dimensions													•	◯	◯
8. No audio signals for arriving elevators	•	◯	●				◯						•	•	•
9. No visual signals for arriving elevators				◯			◯						•	•	•
10. Controls and other features not consistent in all elevators	●	◯	●												
11. Signals do not identify direction of travel for arriving elevator	◯	◯	●	◯			◯						•	•	•

Figure 2.H: Problem Identification Matrix

- • potential problem
- ○ problem
- ◯ severe problem
- ⬤ impossibility

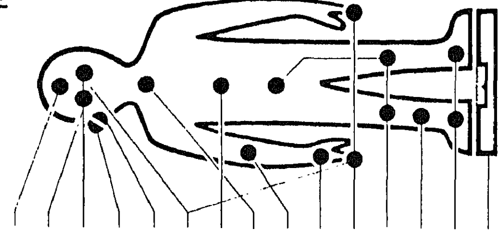


Storage* and Work Surfaces

1. Shelves and other storage facilities located at extremes of reach (high or low)
2. Counters, cabinets or narrow spaces in front of storage units
3. Work surfaces that are at heights suitable only for standing work
4. Work surfaces that are at very low heights
5. No clearances for legs under work surfaces
6. Counters too deep
7. Deep shelves
8. Door swings cause obstructions to use of storage units
9. Lack of illumination inside storage unit

*Includes appliances with storage areas (e.g. oven, refrigerator, etc.)

Figure 2.19 Problem Classification Matrix



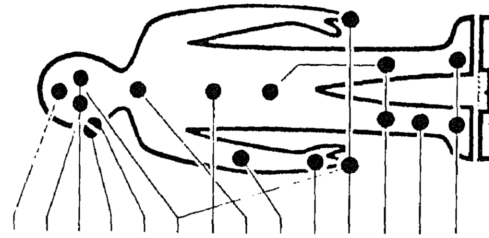
- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility

Space Clearances

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Small clearances for maneuvering close to plumbing fixtures, controls, operable hardware and storage units		◯	◯		◯	◯	•		◯	◯			◯	●	•
2. Small clearances in furniture lay-outs		○	◯		◯	◯							◯	●	•
3. Small maneuvering spaces where turning is required						○							◯	●	•
4. Narrow clearances where paths change direction or turning is required		•	◯										◯	●	•

Figure 2.J: Problem Identification Matrix

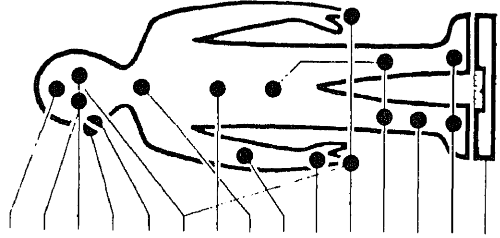
- ● potential problem
- ○ problem
- ◯ severe problem
- ⬤ impossibility



Supports

Supports	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Lack of handrails for maintaining balance					⬤								◯		
2. Lack of shower or bathtub seat					○							◯	◯	◯	●
3. No grab bars for use in transferring into bathrub, onto toilet or onto shower seat					◯	◯	◯					◯	◯	◯	
4. Grab bars set at extremes of reach only					⬤	◯	◯		◯				◯	⬤	
5. Grab bars mounted at high positions														◯	
6. Grab bars mounted at low positions					◯	◯	◯						◯		
7. Vertical grab bar configuration							◯						◯	◯	
8. Grab bars too short					◯	◯	◯						◯	◯	
9. Surface of supports does not conform to hand size					⬤	●				⬤			●	●	●
10. Grab bars or handrails set close to wall					◯	●				◯			◯	◯	
11. Location of grab bars obstructs use of equipment or fixture or circulation around it													⬤	⬤	●

Figure 2.K. Problem Identification Matrix



- • potential problem
- ○ problem
- ◯ severe problem
- ● impossibility

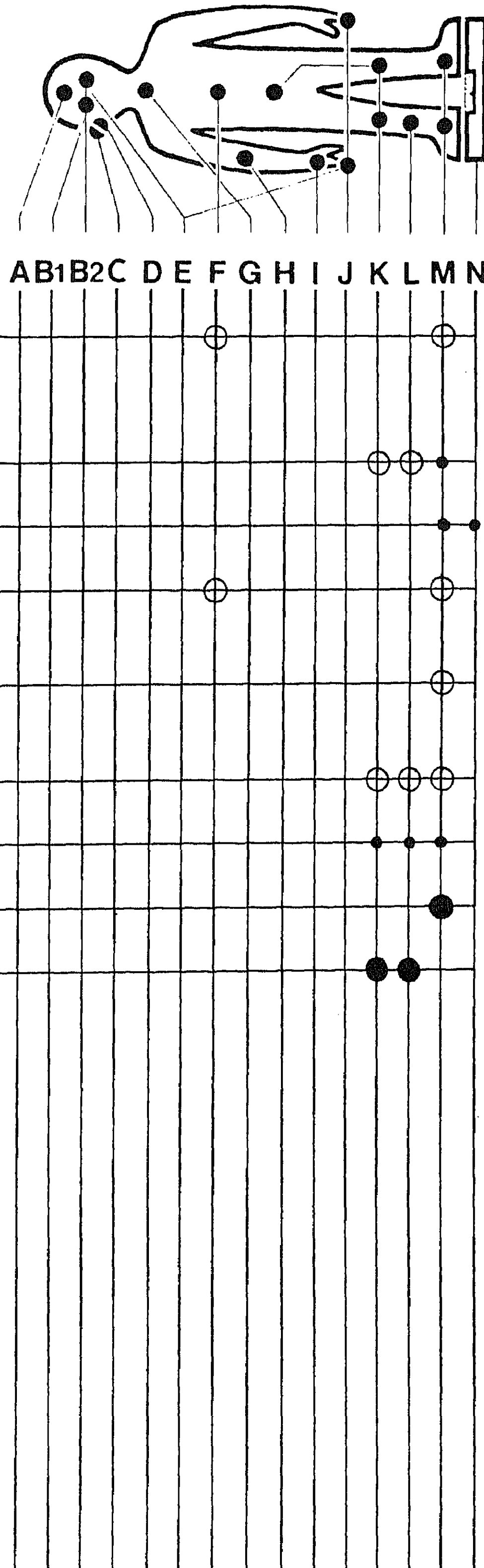
Controls and Operable Hardware*

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Counter-intuitive means of activation	●	○	◯												
2. High force of activation							◯			•			◯		•
3. Ultra-sensitive activation	◯	◯	◯			◯				•	•				
4. Fine motor control required to use	◯					◯				•			•		
5. Very small size		○	○												•
6. Very large size										◯	◯				•
7. Activation requires turning motion of wrist										◯	●		•		
8. Use requires complex manipulation (more than a single movement)	•		•			○				•	•				
9. Use requires two hands										•	●		◯		
10. Use requires hands										●	●		◯		
11. Use requires feet													•	●	
12. Use requires fingers										•	●				
13. Controls and hardware located in very high position								○	◯	•			○	●	•
14. Controls and hardware located in very low position												•	•		•

*Includes controls and hardware on appliances and fixtures.

Figure 2.L: Problem Identification Matrix

- ● potential problem
- ○ problem
- ◯ severe problem
- ⬤ impossibility

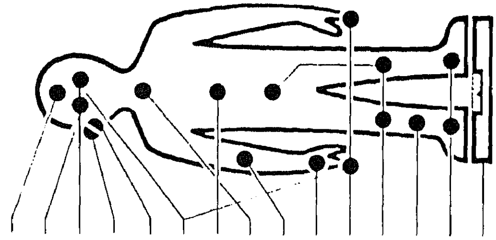


Plumbing Fixtures

1. Sinks and lavatories located at height suitable for use only when standing
2. Low toilets
3. High toilets
4. Exposed pipes and other protrusions under sinks and lavatories
5. Not enough clearance for legs under sinks and lavatories
6. Shower stalls with high curbs
7. Bathtubs
8. Very high drinking fountains
9. Very low drinking fountains

Figure 2.M: Problem Identification Matrix

- • potential problem
- o problem
- O severe problem
- ● impossibility



Communications

	A	B1	B2	C	D	E	F	G	H	I	J	K	L	M	N
1. Signs and markers located out of visual range	O	O						O					O		•
2. Illogical signs and markers	●	O													
3. Signs and markers for hazards and emergency use in only visual mode	•	●	●												
4. Signs, markers, and signals for hazards and emergency use in only auditory mode				●											
5. Signs and markers in complicated or abstract mode	●	O	O												
6. Poor exposure of important signs and markers	O	O	O					O					•	•	•
7. Directories and room markers only in visual mode			●												
8. Small character size	•	O													
9. Identifying signs in only visual mode		•	●												
10. Lack of warning signal for hazards in a path of travel		O	O					•							
11. Public announcement systems using only the auditory modes				●											
12. Telephone systems without visual transmission modes				●											

Conclusion

The Enabler can be used in design and research as a substitution for the conventional image of the disabled person-- the wheelchair user. Its utility, as demonstrated by the problem identification matrices, is that it encourages a more comprehensive view of accessibility-- one that is responsive to the full range of disabilties affected by enviro mental design. Although most guidebooks and manuals on barrier-free design have focused on accessibility considerations for wheelchair users, the problem analysis presented here indicates that there are several areas of concern in building design where inaccessibility has a greater impact on blind and partially sighted people or on people wi limitations in use of arms, hands or fingers. Moreover, since conditi which cause problems for wheelchair users also have a wide impact on people with other disabilities, designers and researchers must conside the needs of those people as well. The resulting barrier-free design measures may be quite different than those meeting the needs of wheelchair users alone.

Future Work

The problem analysis presented here is only an initial step in the analyses of problems of accessibility. A great deal of research is needed to validate the analysis presented here, which is heavily based on professional judgment rather than empirical data. Moreover, there need to determine the priorities of problems and the extent of accessibility needed in various types of buildings. Such information would be particularly useful in renovation programs operating on a fixed bud get, e.g. removing barriers at a University.

Table 1: Accessibility Conflicts and Recommended Solutions

Condition	Conflict	Recommended Solution
1. Curbs at intersections	Elimination of curbs is helpful for wheelchair users but is dangerous to blind people.	Provide a texture change for the curb to define the edge of the street.
2. Warning signals	Visual signals are good for deaf people, but cannot be seen by blind people; audio signals are good for blind people, but cannot be heard by deaf people.	Use both visual and audio modes for warning signals.
3. Controls and hardware	Hand operated controls and hardware are good for wheelchair and walking aid users, but cannot be used by people who have no use of hands.	Sometimes both hand and foot/leg controls or hardware can be used; in other cases only hand controls can be provided (e.g. window or door locks) and this problem can only be solved by electronic means.
4. Control heights	Low heights are good for wheelchair users and people who cannot reach very high, but are a potential problem for very tall people and those who cannot bend easily.	Use compromise height.
5. Height of work surfaces	Low work surfaces are good for people who sit while working but a severe problem for those who stand and have difficulty bending.	Use adjustable or adaptable heights in residences and work places or alternate heights in public places.
6. Overhanging objects	Good way to provide access to equipment for wheelchair users, but dangerous to blind people if the object projects into a circulation area.	Keep objects out of circulation paths.
7. Grab bar mounting height	Low heights help people without use of legs to have leverage while transferring; people who use walking aids, have poor balance or bending and stamina problems use high bars to pull themselves up.	Use compromise height in public facilities and provide alternate heights in residential locations.

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Human Factors Research

6

Introduction

This report is a review of literature in the area of knowledge called human factors or ergonomics, for information relevant to the design of barrier-free buildings. Basic human factors texts were reviewed for information. Citations of articles and books on relevant topics were obtained through computer abstracting services, bibliographies and by reviewing the indices of three journals: *Ergonomics*, *Applied Ergonomics* and *Human Factors*.

The purpose of the report is to identify the role of human factors research in determining how accessible environments should be designed. This determination may be used to set the scope of further research efforts and to develop improved research methods.

Origins and Scope of Human Factors Research

Murrell defines ergonomics as, "the scientific study of the relationship between man and his working environment" (Murrell, 1965, p xiii). This includes tools, materials, methods of work, organization of work, and the ambient environment of climate, illumination, spatial volume, etc. Murrell traces the development of this research field to the 1920s. At that time, in England, there was an effort to study factors contributing to improved work; the Industrial Fatigue Research Board, for example, did research on the performance of industrial workers. In the U.S., Taylor and Gilbreth developed the principles of time-motion study.

The 1930s, as one would expect, brought a decline of interest in this field since manpower was expendable and there was little value in research to make it more efficient. With the advent of World War II, however, equipment became so complex and operating speeds so high that poor efficiency and operational failure became critical issues. The best embodiment of these problems is the airplane. In both England and the U.S., extensive research programs developed, mainly associated with military problems.

In 1949, in England, an interdisciplinary group of researchers in human performance formed the Ergonomics Research Society, taking the word "ergonomics" from the Greek *ergos*: work, and *nomos*: natural laws.

Since then, ergonomicists, or human factors researchers, as they refer to themselves in the U.S., have done an extensive amount of work related to military and space programs as well as industry. As Murrell points out, they have shifted their focus from humans as producers to humans as controllers. This has brought an expansion of research interests from the physiological aspects of work to the point where human factors re-

Human factors research has always been geared toward generating information for design of environments. The pressure of the need for such information has resulted in the publication of many manuals which are essentially design cookbooks, filled with recommendations based on research and practice. Generally, human factors is concerned with:

1. Perception of information, including visual displays, auditory and tactual displays and speech communication;
2. Mediation and control processes such as recognition, acquisition of skills or knowledge, and control responses;
3. Physical output activities, including the performance of the skeletal muscle system, physiological stress, energy expenditure, reaction and response times;
4. Work space design, including anthropometry, arrangement and utilization of physical space; and
5. Ambient environment, including illumination, climate and acoustics.

This extensive scope of concerns has evolved gradually through the use of a concept of the human being as a component in a larger system, generally in association with a machine. Through the concept of a "man-machine" system, human factors analysists recognize the complex interrelationships between the human controller and the physical components of the system. Their view of the human is often based on a stimulus-response theory of human behavior. For example:

> "Information may also be conveyed through the sense of smell, through touch, through sensations of heat or cold, or through kinesthesia. This information is conveyed through the nervous system to the central mechanism of the brain and spinal cord where the information is processed to arrive at a decision.... Having received the information and processed it, the individual will then take action as a result of the decision and he will do this through his effector mechanism..." (Murrell, 1965, p 15).

The goal of all man-machine systems is the most efficient level of outp (which may be defined by the human factors analyst as either work or merely response) with a minimum of errors on the part of the human or failures on the part of the system as a whole.

The man-machine system is viewed as being immersed in an ambient enviro ment with innumerable influences on the status of the system. Although as in the quote above, the primary task of such a system is the transla tion of an information input into an action by a human, it is understoo by the human factors analyst that general illumination level, atmospher climate and other ambient environmental factors have an important effec on performance of the system beyond the effects of the immediate machin environment.

environments such as mass transit systems and space stations. The focus again has been efficiency of system performance.

Unlike other areas of research on the relationship of people to environment, human factors research has consistently produced hard data directly applicable to design and with the goal of effecting a better fit between people and their physical surroundings. This may be due to the measures of success that are used in this field-- measures of human performance in terms of efficiency. Equipment designed according to reliable human factors principles has a likelihood of being safer, easier to operate, less fatiguing, and more responsive to use.

Buildings as Task Environments

Although human factors research has been concerned primarily with man-machine systems, much of the knowledge it has generated can be applied to problems of building design. In fact, some human factors manuals have sections devoted to building environments. Beyond the transfer of existing knowledge, human factors approaches to research can be extremely useful in generating building design criteria. To facilitate such transfer and generation of information, it would be useful if we could conceive of a "human-building" relationship in the same way that a human factors analyst conceives of a man-machine relationship.

In a man-machine system, the human operator obtains information from the machine via dials and other information displays. The operator also obtains, from the ambient environment, information such as temperature conditions, illumination, etc. After making decisions about the information received, the human acts, usually by controlling the machine.

In a building environment, the machine or equipment is not the primary source of information nor is its control the ultimate aim of human activity. Thus, the conventional man-machine system concept will not be very useful, for analysis purposes, when applied to buildings. However, both a machine (and its ambient setting) and a building can be conceived of similarly as a task environment: surroundings within which a purposeful human task takes place. Such a conception is a broader model of a human-environment relationship than that typically used by the human factors' analyses. Yet it is consistent with the human factors approach to the work station. In actuality, research on work stations for housework is directly applicable to building design (Grandjean, 1973).

Given the concept of task environment, the research or design goal is to identify the most conducive environment for the human task at hand. As an example, one design goal is the support required for making it easy to find one's way around in buildings. Research can identify what kind of support is needed. Another design goal is the layout required for the shortest travel time between a series of places within a building. Research can identify rate of travel and which places should be closest.

ceiving of a building as a task environment for access allows an analysis that can identify, in human factors terms, all the important considerations for insuring accessibility to buildings by disabled people. The experience of human factors researchers in designing task environments should provide a fresh approach to barrier-free design that puts accessibility concerns into an integrated framework of human performance. If this can be accomplished, a more systematic and thorough study of access can be undertaken.

Moreover, present criteria for barrier-free design are highly fragmented and have no overall organizational coherence. This leads to difficulty in interpretation, lack of flexibility, and poor understanding on the part of those that use the criteria. The overlying concept of a building as a task environment for access could provide the organizational tool needed to improve the effectiveness of barrier-free design criteria.

Access is concerned with moving into and about buildings and operating equipment found in them. This includes these tasks:

1. Passing through openings,
2. Operating electronic and mechanical controls,
3. Moving along routes of travel,
4. Negotiating changes in level,
5. Transferring from one body posture to another,
6. Searching for direction-finding information,
7. Interpreting information displays,
8. Negotiating a series of movements within a confined space,
9. Negotiating through human and vehicular traffic, and
10. Avoiding hazards in the path of access.

In terms of access, a building is successful when it facilitates the tasks above to the greatest extent possible. A task environment that prevents or inhibits people from completing any of these activities presents barrie to access. Physically disabled people commonly experience such barriers. However, conceptualizing accessibility in the above fashion highlights the fact that able-bodied people also experience many barriers to access. For example, a common problem in buildings open to the general public is finding a restroom. Although a person who uses a wheelchair may not be able to use a poorly designed public toilet when they find it, both disabled and able-bodied people experience difficulties in the search for restrooms.

Thus, an understanding of access, as a set of tasks in the use of building common to all building users, identifies its importance as a general measure of successful design. Designing a building as a task environment for access is clearly of importance to those who are able-bodied as well as to those who are disabled.

Defining the Task Environment

Starting with the set of tasks identified as components of access, it is

possible to identify the explicit information needed to design an accessible building. These needs are presented in Table 1 . Associated with the information needs are a series of problem-specific contingencies which affect the definition of the task environment. For example, a toilet stall that is used by only ambulatory people does not have to be wide enough to accommodate a wheelchair. Since only a small number of people in wheelchairs would use a large restroom means that only a small number of stalls would be needed to accommodate them.

By satisfying the information needs and identifying the contingencies for a particular building design problem, any task environment for access can be defined. If data is not available to satisfy the information needs, there is a knowledge gap.

The remainder of this report, describes information from human factors research that is related to the design of buildings for access. Much of the work in the human factors area has concerned environments other than buildings. However, using the task environment concept, it is possible to transfer much existing human factors knowledge to the building context. This report will not detail specific design recommendations from research; that level of information can be presented more appropriately elsewhere. Here, the main concerns will be assessing the scope of past research, the principles that are useful for design, the methods used in research, findings of selected studies, limitations, and future directions.

The following review of human factors knowledge is focused on these four areas of the field:

A. Functional anthropometry,
B. Biomechanics,
C. Information display,
D. Specific task environments.

It is these areas that can provide information pertinent to access. Some relevant comments on research methods are also included. The discussion of research findings is limited only to studies that were concerned specifically with accessibility of buildings to physically disabled people.

Functional Anthropometry

Anthropometry is the measurement of the physical features of the body. It is a consideration in access since a building and its equipment must accommodate the size and shape of a human user. It can be a basis for the design of building products, equipment, and maneuvering space. Static anthropometry refers to measurements of people in fixed positions while dynamic anthropometry refers to measurements of the pattern of body movements as a person performs physical functions.

Task	Information Needs
1. Passing through openings	a. Height of openings b. Width of openings c. Shape of openings d. Maneuvering clearances
2. Operating Electronic and mechanical controls	a. Configuration of control b. Location vis-a-vis reach c. Force of activation d. Activation motion e. Speed of activation f. Relationship to other control. g. Type of feedback
3. Movement along route of travel	a. Characteristics of surface b. Friction between user and surface c. Length of routes d. Width of path e. Exposure along route (to climate) f. Overall pattern of circulation
4. Negotiating changes in level	a. Degree of slope for ramp incline b. Configuration of stair nosing c. Stair shape and size d. Length of run for incline of stairs e. Location and configuration of assists f. Configuration and size of landings
5. Transferring from one body posture to another	a. Number and type of assists needed for transfer b. Location and configuration of assists c. Strength of assists d. Size and configuration of transfer clearances e. Size and configuration of built-in elements that are transfer points (e.g. toilet)
6. Searching for and interpreting direction finding information	a. Information needs b. Type of coding method c. Location of display d. Exposure of display e. Content of information needed f. Number of displays needed g. Complexity of information transmitted h. Symbolic content of information
7. Negotiating a series of movements in a confined space	a. Size and configuration of clearances b. Layout of elements in a space c. Proximity of elements to each other
8. Negotiating human and vehicular traffic	a. Constraints on traffic flow b. Controls on flow rate and direction c. Separation of human and vehicular traffic
9. Use of fixtures, storage and work surfaces	a. Height b. Approach clearances c. Configuration of fixtures d. Size
10. Avoiding hazards in the path of access	a. Definition of hazards that should be avoided b. Configuration of hazard-free zone c. Size of hazard-free zone d. Guards against exposure to hazards e. Size and configuration of warning signals

1. Principles

An important factor in use of anthropometric data is to allow tolerances for encumbrances such as clothes, bundles and prosthetic devices that people are likely to have with them as they move about. For instance, exterior door handles should be designed to accommodate a gloved hand if they will be used on buildings in cold climatic zones. Along the same lines, it is necessary to include consideration of prosthetic devices and their operating characteristics. McCormick gives these principles for use of anthropometric data (McCormick, 1970, pp 390-391):

1. Design for extreme individuals. Use the dimension of the limiting factor that would accommodate all individuals in the population concerned. Generally, minimum dimensions should be based on upper percentile measurements while maximum dimensions should be based on lower percentile measurements.
2. Design for an adjustable range, when minimums or maximums will not accommodate people of varying sizes, e.g. automobile driver's seat.
3. Design for the average, only when it is not appropriate to design for minimum or maximum values and not feasible to provide an adjustable range: e.g. a supermarket checkout counter, which is designed for the very tall would not work for the very short.

A basic guideline in applying anthropometric data is to use dimensions from the intended user group. This seems to be a banal statement when applied to buildings because it appears impossible to predict, for example, whether women or men or children or elders whould use a certain doorway. Although it may be difficult in many cases, in others the user population may be quite easy to predict. Elementary schools, for example, could be analyzed to identify those dimensions that should be child sized and those that should be adult sized. Moreover, it is unlikely that an elderly person would consistently utilize the school building. Before there were many male teachers at elementary levels, it would have been possible to narrow the target group even further to children and adult women. Of course, in the U.S. one would also use dimensions representative of the U.S. population.

In summary, the functional use of anthropometric data requires consideration of these questions:

1. Is dynamic or static data the most appropriate?
2. What encumbrances might users have with them?
3. Can minimum and/or maximum values be used?
4. Will an adjustable range of values be necessary and feasible?
5. Is design for the average values necessary?

Once these questions have been answered, data sources can be reviewed to satisfy information needs.

2. Data Sources

The most extensive anthropometric surveys have been with military populations for the purpose of designing well-fitting military equipment. Civilian surveys have not been as extensive, particularly in the U.S. This means that the best data available pertains mostly to able-bodied males of military age. Data on other user groups tends to be based on small samples in different countries.

The two most comprehensive sources of anthropometric data available that are appropriate for building design are the Swedish study, Anatomy for Planners (Thiberg, 1965 and 1970) and the American, Humanscale 1, 2, 3 (Diffrient, et al., 1974). Anatomy for Planners consists of a series of four reports detailing the status of anthropometry throughout the world. It gives illustrations of all measurements and plots the values for those measurements as found by the various studies surveyed. A total of 928 studies were reviewed (not all primary sources) by the Swedish team.

Humanscale is an extensive compilation of anthropometric data presented in a form directly useful for designers. It was developed over many years by an industrial design firm, and so is not only based on many anthropometric studies but is field tested through design and use experience.

Anthropometric data is usually presented in the form of percentile ranks by sex; for instance, dimensions are given for the ninety-fifth percentil man or the fiftieth percentile woman. Usually a study will be concerned with a particular age group as well. Humanscale and Anatomy for Planners present data by different age groups as well as by sex and percentile level. Since anthropometric dimensions are genetically based, ethnic origins are also an important consideration. Anatomy for Planners identifies countries of origin for the data surveyed. Humanscale presents relationships between measurements, so that it is possible to determine the sitting height, width, reach and other dimensions of people having different standing heights. Humanscale also has data on tolerances for clothing, prosthetic devices and luggage.

A review of available anthropometric data sources highlights several important areas in which information is needed:

1. There is a lack of comprehensive dynamic anthropometric research.
2. The civilian group of the population is understudied.
3. There is little data on people over 50, women, disabled people and children, although the situation regarding children is improving.

however, estimates of change can be made with corrective factors.

5. There is little situational data (measurements taken during actual activities) of the kind useful to building and building equipment designers, since existing data has been gathered primarily by the military, the clothing industry and racial biologists.
6. Most of the data has been gathered through research methods utilizing posed positions; it is questionable whether such data can be transferred to situations where natural body movements will be used since the exact body postures measured in anthropometric studies might not be typical in natural situations and when motivational factors come into play.
7. There is little comprehensive data on encumbrances, including prosthetic devices, packages and luggage.
8. There are few comparative studies that highlight differences between user groups.

Dynamic anthropometric data is most appropriate for application to the problem of access. Some dynamic data is available related to work space envelopes (e.g. McCormick, 1970). Situational data is also very useful as applied to design for access. There is some data available in this regard, basically from Anatomy for Planners.

Focusing specifically on anthropometric data for people with disabilities, there is not a definitive study. Some data is available in design manuals and standards without descriptions of research methods and/or samples of subjects (e.g. ANSI, 1971). Some data is based on estimates derived from the dimensions of able-bodied people interpolated into wheelchairs (e.g. Goldsmith, 1967). Generally, the existing studies have focused on wheelchair users, rather than people with all types of disabilities. Some situational and dynamic data on people with disabilities is available from studies of human performance, e.g. best dimensions for doors, turning radius, shelf heights, etc. It is these last sources of information that probably provide the most useful information, since they are concerned with measurements directly relevant to building design. That data will be discussed in other sections of this report.

Biomechanics

Biomechanics, or body movement and strength, are important concerns in designing task environments for access. The selection and position of equipment, controls and information displays, the means of changing level, and the requirements for speed in movement should be considerate of limitations in physical activity. McCormick identifies these operational criteria of physical activity that serve well as design factors for access (McCormick, 1970, p 290):

1. Range of movement,
2. Accuracy

Movement, by its very nature is inefficient. A general principle in establishing design requirements is to require little deviation from initial (natural rest) positions in a motion. For example, in determinin positions of information displays, angles of vision required to view the display should not assume rotation of the head. As a second example, the movement of an optimal door opener should not require pronation or supination of the hand. This design principle effectively reduces required motions to a minimum and accommodates the greatest portion of the population. It can be used effectively in design of task environments for access.

Data on range of movement for able-bodied people, including movement of limbs, digits, bending and twisting is available (e.g. Murrell, 1965). Individuals have variability in their ranges of motion as they do in their body sizes. Many body movements of disabled and aged individuals may be severely restricted, but comparable data for older and disabled people is available on only a small number of motions.

McCullough and Farnham had wheelchair users draw arcs of reach on a horizontal work surface (McCullough and Farnham, 1960). Table 2 shows their findings for depth and width of arcs. Floyd, et al., had wheelchai users mark forward and side reaching arcs on a vertical surface (Floyd, et al., 1966). Their results are shown in Table 3 and Table 4. McCullough and Farnham used a sample of 20 female university students anc six others from the local community. The subjects had various causes of disability. Floyd, et al. used a sample of 76 male and 28 female paraplegics all of whom had spinal cord injuries. About 30 percent were athletes participating in the National Paraplegic Games, another 30 percent were former patients of the rehabilitation center where the study wa carried out, and the rest were in-patients. McCullough and Farnham did not describe their sample in sufficient detail to know how limiting their disabilities of reaching were. Floyd, et al. included only paraplegics. We can assume that none of that sample had serious problems in using the arms. Both samples omitted people with limitations of reaching who did not use wheelchairs. Finally, both samples had a large proportion of young, active people.

2. Accuracy

Accuracy of movement is related to the muscles involved and the position of the limbs. For example, where great accuracy is required, hand and arm movements should be used rather than foot and leg movements. Also, hand movements are more accurate when the hand is held in close to the body at approximately elbow level. Accuracy in limb control is dependen on the antagonism of two groups of muscles. This principle extends to control movements which are more accurate when two limbs are used in antagonism than when one limb is used alone (Murrell, 1965, p 49).

Table 2: Horizontal Reach from a Wheelchair[a] (in inches)

	Width	Depth
Range	40-64	15-26
Average	51	21

[a]Source: McCullough and Farnham, 1961

Table 3: Horizontal Reach from a Wheelchair[a] (in inches)

	Side Comfortable	Side Maximum	Front Comfortable	Front Maximum
5th Percent Females	12	18	21	30
Mean (females)	16	23	26	39
Mean (males)	18	25	28	42
95th Percentile Males	21	32	32	52

[a]Source: Floyd, et al., 1966

Table 4: Vertical Reach from a Wheelchair[a] (in inches)

	Side Comfortable	Side Maximum	Forward, at Toe Projection
5th Percentile Females	59	61	42
Mean (females)	63	65	53
Mean (males)	66	68	58

People with disabilities may not be able to achieve the same level of accuracy in movement due to:

1. Loss of use to upper limbs,
2. Loss of use to a limb which hampers use of the antagonism principle, or
3. Lack of accurate limb control due to upset in the balance of opposing muscle groups.

Although no specific information is available on accuracy of movements for disabled people, these general human factors principles can be used in design of equipment:

1. Accommodation for inaccurate movements, e.g. providing telephones with one large coin slot rather than with slots for each coin denomination;
2. Elimination of accuracy requirements, e.g. automatic adjustments;
3. Built-in opposition from controls to provide an increased measure of accuracy as that which opposing limbs would provide;
4. Positioning for most accurate use, e.g. location of a thermostat at elbow height.

Of course, a common sense principle is to avoid the need for accurate movements as much as possible.

3. Speed

Since a great deal of human factors research is concerned with control of machines at extremely high speeds (aircraft and space vehicles), much research has focused on speed of human performance. Speed is based on both response time and reaction time. Most of the information on speed is not important for access to buildings because the use of buildings is a very low speed activity in comparison to controlling an aircraft. Thus, a reaction time of 0.2 seconds has little meaning in regard to the type of reactions associated with building use. However, speed of movement, in a gross sense, does have implications for access, particularly when one is concerned with pedestrian and vehicular circulation and emergency systems where quick reaction and response is critical. Some design applications where speed of movement is an important consideration are:

1. Timing of elevator doors, other automatic doors and self-closing doors,
2. Timing of traffic lights,
3. Routing of pedestrian traffic with respect to vehicular traffic,
4. Layout of pedestrian traffic intersections,
5. Travel time from one place to another,
6. Width of passageways, stairways and ramps where heavy traffic flow is expected,

7. Design of emergency exit systems,
8. Selection of alarm systems.

There has been some research on rates of travel of pedestrians (Fruin, 1971 and Pushkarev and Zupan, 1975) but no research specifically with disabled people, many of whom can be expected to have greatly reduced rates of travel.

There has been a great deal of research on speed and timing in relation to age. Birren characterized performance of older people as a general slowness in behavior in accordance with the demands of a situation. He summarized these factors leading to slowness of behavior (Birren, 1964):

1. Stimuli that are weak or low intensity,
2. Ambiguous or unfamiliar stimuli,
3. Unexpected stimuli,
4. Stimuli that tend to evoke conflicting responses,
5. Difficult and complex stimuli,
6. Responses that must be made in sequence,
7. Responses for which there are great consequences.

Although these factors affect the old as well as the young, central nervous system changes associated with age (as yet largely unexplained) present a generalized slowness among older people that extends the effects of these factors (Birren, 1964, p 129).

People with physical impairments may have severe handicaps in speed of physical activity. It is clearly obvious, for example, that a person who uses crutches will not be able to move along a pathway as quickly as an able-bodied person.

Although there are no specific data on speed of human performance of disabled people relevant to designing environments, there are definitely some broad principles that can be established in this area:

1. Use clear, familiar unambiguous and expected stimuli for evoking reactions,
2. Avoid conflicting, difficult and complex stimuli to evoke reaction,
3. Allow extended time for sequential activities and those that have important consequences,
4. Allow extended time for old and disabled people to accomplish tasks,
5. Keep paths of travel short when elapsed time for a journey is critical such as paths to fire exits.

4. Strength

Strength has also received much human factors research attention. As with speed of movement, however, most of the research is inapplicable

doors or windows, have not been studied.

Some findings from research on strength are relevant. One research area identifies the capabilities of different body positions in exerting force. Such studies have identified, for example, that a greater force can be applied if the right hand is rotated counterclockwise from the supinated position than clockwise from the pronated position (Murrell, 1965, p 59). Such information is useful for deciding on the type of door opener to select. Results of static tests of force can be used for design recommendations such as the force required to open a door. Since body movements in the direction of the force would increase human potential, recommendations based on static force abilities would be satisfactory as guidelines for the maximum force required to open a door.

Evidence indicates that strength generally declines slowly from the middle or late twenties to the point where, at age 65, strength is about seventy-five percent of earlier capabilities. This can be used as an adjustment factor for older user groups. For disabled people, the data situation is as poor as with the range of motion. Although case data is undoubtedly available, comprehensive data has not been assembled.

5. Endurance

Endurance is closely related to strength as an energy expenditure concern. Again, in buildings, this factor is not as crucial as in other task environments that have been studied more thoroughly by human factors researche Perhaps comfort is a more appropriate concern for most building users than endurance. However, for disabled and elderly populations, endurance problems are very much a reality. Endurance is an important concern in access with respect to:

1. Slope of ramps and stairs,
2. Configurations of stairs,
3. Choice of method in accommodating level changes,
4. Length of traverse, and
5. Locations of resting and waiting places.

Research attention has been given to the first three points above for able-bodied people. Templer has completed a thorough study of stair shape (Templer, 1974). It is also known that ramps require more effort than stairs (Corlett, 1972). Furthermore, the biomechanics of stair and ramp climbing indicate that knee flexion may be the limiting factor in use of stairs and ramps by elderly and disabled people. Thus, shallow ramps are recommended for those groups (Corlett, 1972).

Two studies have examined the abilities of wheelchair users to negotiate ramps. Walter (1971) used a sample of 57 subjects all of whom were disabled and were either patients in an institution or welfare clients. The entire sample was above 50 years of age. Forty-four used manual wheelchairs independently; the rest used electric wheelchairs or had attendants. In this study, 20 foot and 10 foot ramps could be adjusted to

various slopes, individuals negotiated the ramp at the steepest slopes possible. On the basis of his findings, Walter recommended a 1:16 slope for 20 feet and a 1:10 slope for 10 feet as maxima for ramps to be used by wheelchair users. Elmer (1957) used a sample of paraplegics, all of whom were university students in a pioneering program that sought to encourage universities to accept disabled people as students. All used manual wheelchairs. A ramp of variable length and pitch was used to test out relationships of slope to length. On the basis of his findings, Elmer concluded that a 1:8 slope was acceptable as a maximum for wheelchair users.

On the last two points in the list above, there is no specific data. These two concerns should receive attention with disabled and elderly subjects. It is unlikely that they would cause great problems for able-bodied young adults with no encumbrances.

Information Display

The term "information display" is used here to include a) stimuli whose sole purpose is to convey information, such as a building directory or a control dial, and b) information presented through design cues that are necessary for use of environments, such as the shape of a door opener as a clue to its functioning. Information displays can be used for many purposes:

1. To inform people how to use an unfamiliar or complex environment (e.g. room numbers),
2. To make people aware of events (e.g. emergency warnings),
3. To provide information that must be transferred over a distance or through sensory barriers (e.g. doorbells), and
4. To provide feedback about a person's own actions (e.g. elevator panel indicator lights).

Relevant human factors knowledge applicable to these problems concerns the coding and organization of sensory inputs. The bulk of research in this area has focused on instrumentation problems, e.g. the most effective altimeter dial design, or the design of information transfer systems, e.g. telecommunications. But many of the principles discovered in this work are appropriate for use in design of buildings as well. These principles apply to disabled people as well as able-bodied people.

1. Coding

Coding involves selection of specific symbols to represent elements of information. There are two general types of codes, unidimensional and multidimensional. Unidimensional codes are symbols that present one distinct meaning, such as the dollar sign or red light. Multidimensional codes combine two or more dimensions of meaning, such as a speed sign in which the shape indicates the purpose of the sign and the number indicates the limit. Multidimensional codes, such as color coded numerals,

may also present redundant information. Multidimensional codes increase the level of information that is transmitted but there are also limits beyond which additional dimensions are not useful (McCormick, 1970, p 99).

Coding dimensions can be based on sensory modality: visual, auditory, and/or tactile. Or they can be based on signal methods such as: frequency, intensity or size, duration, direction, and color. Research has investigated the effectiveness of various modalities and signal methods and many detailed recommendations are available (see McCormick, 1970, for examples). Generally, two basic principles in coding are to use dimensions that allow the presentation of distinctly different signals and to choose dimensions based on an appropriate fit with content of message and user abilities.

An important concern in coding is the compatibility between coded messages and the expectancies or "set" that they seek to elicit. If an information display contributes to an expectancy that is not compatible with the use of the environment, difficulties in interpretation will result. An example of compatibility is a signal that illuminates when an elevator car reaches the floor. Incompatible signals would result if there were two lights in the signal-- a bottom light that lit up for an up car and a top light for a down car.

There are stereotypical expectancies for some signal methods. Also, expectancies can be developed through consistent patterns, e.g. hot water on the left, cold on the right. Symbolic associations of codes are closely related to the idea of compatibility. The use of pictograms, for example, can be extremely effective in conveying messages. Standardization of codes, particularly symbolic codes, enhances their effectiveness by allowing them to convey more meaning and eliminating language barriers. The international symbol of access tells individuals that a building is accessible to disabled people even before they enter it. Without standardization, of both signal and its application, the symbol would be less meaningful because differences in interpretation would result in less reliability.

2. Organization of Input

Organization of information concerns the load or amount of information to which one must attend, the speed at which one is exposed to information, and the sequence in which exposure occurs. General principles regarding organization of information are:

1. To provide a limited number of information sources,
2. To allow a reasonable rate of information exposure,
3. To avoid "bunching" information within short intervals, and
4. To allow, where feasible, individuals to control the rate of information reception themselves.

exposure easily by their own actions. One area where it is critical, however, is the avoidance of hazards. A person can easily make a fatal error if presented with too much information too fast, as when negotiating vehicular traffic intersections. Some recent ongoing research suggests that information loads that distract a person's attention when negotiating stairs may be the cause of many stairway accidents (personal communication, John Archea, 1974). Such problems can be resolved by controlling information exposure in hazardous situations.

3. People with Impaired Senses and Perceptual Processes

Design of information display is particularly crucial to older people, people with visual impairments, people with hearing impairments, and other people who have difficulty interpreting information. Associated with the process of aging are changes in central nervous system functioning and sensory reception that decrease the threshold levels for detecting stimuli, and that make it more difficult to integrate information presented at high speeds (Birren, 1964). Several sources suggest that information display for older people should use sensory reinforcement (multidimensional coding) to insure that messages are received and integrated (Pastalan, 1973). Also, it appears that for older people, information should be organized with slowness of interpretation in mind (Birren, 1964).

For those people with disabilities that affect one sense modality, alternate modalities must be used to achieve information levels. People with visual impairments have the most difficulty obtaining coded information from the environment since human beings, as a species, depend on vision for the majority of their information requirements. The designed environment does not usually provide the same level of information content in other sense modalities as in vision. People with hearing disabilities, although not as handicapped in information access as those with visual impairments, do have difficulties with information that is usually restricted to the auditory modality, e.g. warning buzzers, traffic noises, etc. Many people with sensory disabilities have selective problems, such as high-tone hearing loss, that only partially limit the use of a sense modality. Information displays for people with these types of disabilities can be developed using the impaired modality but choosing signal methods that are able to be received. For instance, a low frequency warning buzzer can be detected by a person with high-tone loss.

For those who have difficulty interpreting information, the use of multidimensional, compatible and simple codes can compensate for lack of interpretive ability.

Generally, the information display requirements of sensory impaired people can be determined easily if dysfunctions in perceptual abilities are known. Two areas of research that have received little study, however, are the use of touch as a modality for emergency signals, and

environment? Answers to questions like these can provide valuable data on how the environment should be structured to optimize information acquisition for people with impaired senses.

Research on Specific Task Environments

Apart from certain general research, a great deal of human factors work concentrates on environments for specific tasks. Some of these efforts, and others by people who do not identify themselves as human factors analysts, are concerned directly with issues of access.

Relevant research has been concerned with use of kitchens, use of bathrooms, use of windows, use of door openers and doorways, maneuvering wheelchairs in tight spaces, use of telephones, and mobility of blind people outdoors.

Two major reviews of human factors research on home environments are available: Ergonomics of the Home by Grandjean (1973) focuses on European experience and Work in the Home by Steidl and Bratton (1968) focuses on American experience. Each source contains detailed recommendations, many of which apply to access. Ergonomics of the Home, as its title indicates, has a greater scope than housework alone. It contains much material on general use of dwelling units including safety, thermal comfort and lighting.

Although sources identified above give little or no attention to bathrooms a major study of this task environment, The Bathroom by Kira (1966), is available. The empirical research leading to The Bathroom was very comprehensive with respect to able-bodied people, but it did not give attention to disabled people at all. However, the second edition of the book gives untested guidelines for bathroom design for use by people with disabilities.

The two major reviews indicate that most human factors research on home environments have focused on the kitchen. Again, much information is available from empirical studies using able-bodied subjects, but there is little empirical work with disabled people. Howie (1968) and McCulloug and Farnham (1960) studied the use of kitchens by disabled homemakers. Howie's study was a field survey of the use of kitchens by disabled women, four of whom were wheelchair users. Since kitchens studied were in the individual's own home and many were inadequate as kitchens by today's standards, only problem identifications and some general recommendations are useful. McCullough and Farnham, however, used an experimental kitchen in which counter heights, shelf heights and kitchen layout could be changed to provide optimal conditions. This allowed an investigation that could be used to generate specific recommendations. Their sample of wheelchair users is described under "Range of Movement", above. Their findings were that counter heights of 24 to 29 inches (26 inch average) at the mix center and 28 to 35 inches (31 inch average) at the sink were comfortable for kitchen work. The findings for reach to upper shelves are shown in Table 5. McCullough and Farnham

Table 5: Reaching to Upper Shelves[a,b] (in inches)

	Open Shelves	Full Height Storage Unit	Over Base Cabinets	Over Open Counter[c]
Range	44-56	54-70	42-56	43-56
Mean	52	61	49	49

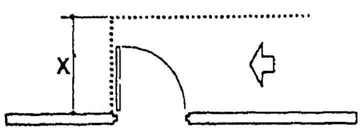
[a]McCullough and Farnham, 1961

[b]Subjects placed a glass and (if they could) a stack of plates at the rear of the shelf -- results were not reported separately for each task.

[c]Only a partial sample of 8 people were tested here.

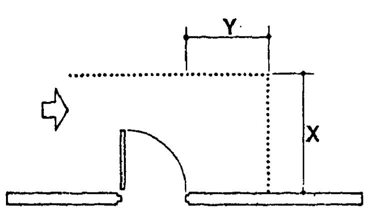
Table 6: Space Requirements for Maneuvering Wheelchairs in Front of Doorways (in centimeters)

A.



Researcher	X	Clear Opening
Walter	126	80
Brattgard	100	78
Ownsworth[a]	100	77.5
Nedrebo[a]	135[b]	76.1

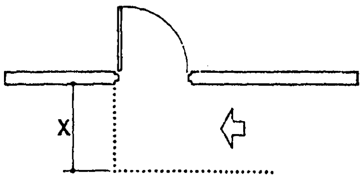
B.



Researcher	X	Y	Clear Opening
Brattgard	120	110	78

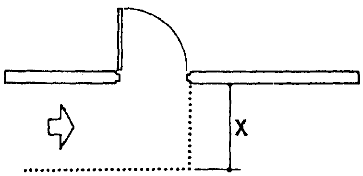
Table 6: continued

C.



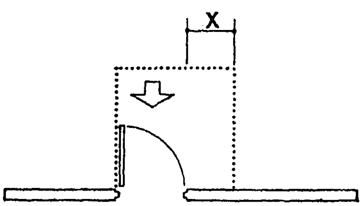
Researcher	X	Clear Opening
Walter	120	80
Brattgard	100	78
Ownsworth[a]	100	77.5
Nedrebo[a]	122[b]	76.1

D.



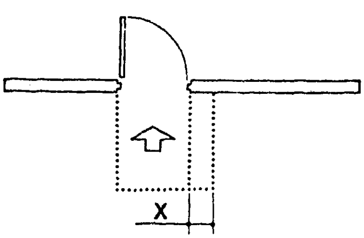
Researcher	X	Clear Opening
Walter	120	80
Brattgard	100	78
Ownsworth[a]	100	77.5
Nedrebo[a]	125[b]	76.1

E.



Researcher	X	Clear Opening
Walter	33	80
Brattgard	30	78
Nedrebo[a]	60	76.1

F.



Researcher	X	Clear Opening
Brattgard	20	78
Nedrebo[a]	30	76.1

[a]Source: Brattgard, 1974

best layout for wheelchair users, although several types were usable, given suitable clearances.

Use of windows has been studied with able-bodied subjects. Hyde (1972) had able-bodied individuals open various types of window devices. Such research with disabled people has not been done.

Nichols evaluated the utility of various door opener designs with a sample of 51 people who had disabilities affecting the use of hands. A lever handled design conforming to the shape of the hand was found to be most usable (Nichols, date unknown).

Walter, Brattgard, Ownsworth and Nedrebo have each studied the use of doorways and the minimum clear width of passage required by wheelchair users. Walter's sample is described under "Endurance", above. Brattgard used a sample of fifteen disabled and two able-bodied people in wheelchairs. The subjects had varying degrees of disability and were divided into a group having good use of arms and a group having poor use of arms. Ownsworth used a sample of fourteen able-bodied and six disabled people in wheelchairs. Nedrebo's study, as reported by Brattgard, used a sample of paraplegics, all with good use of their upper body (size of sample is unknown). Findings from these studies are shown in Table 6.

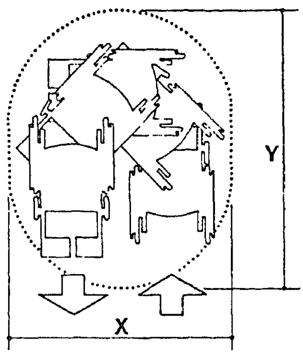
Walter, Brattgard, Nedrebo and McCullough and Farnham all studied turning of wheelchairs through 180 degrees. Their findings are shown in Table 7. All of the above, except McCullough and Farnham also studied the minimum dimensions necessary to make a right-angle turn. The findings are shown in Table 8.

The American Telephone and Telegraph Company commissioned a study to determine a universal height for mounting public telephones (AT&T, 1975). Demonstration telephones were brought to various field locations around the U.S. Wheelchair users and able-bodied people tested the use of the telephone mounted with a coin slot at 54 inches from the floor. The findings indicated that this height was suitable for both ambulant and nonambulant people.

Finally, there have been two studies on the use of tactile and auditory maps to help blind people negotiate through complex environments (Leonard, et al., 1970 and Kidwell and Greer, 1973). These studies have focused on outdoor settings and provide many general insights into the environmental cues needed for orientation over complex routes. However, neither of these studies tested differences in environmental design and thus do not provide specific findings on optimal environmental conditions.

One important benefit of studying specific task environments is that relationships between various elements in a specific task setting can be investigated. Thus, research on kitchens has shown that kitchen tasks should not be organized like an assembly line, starting in a strict linear sequence with raw materials in storage and ending with finished meals on the table. Instead, kitchen tasks have been found to be more

Table 7: Space Requirements for Making an 180° Turn in a Wheelchair (in centimeters)



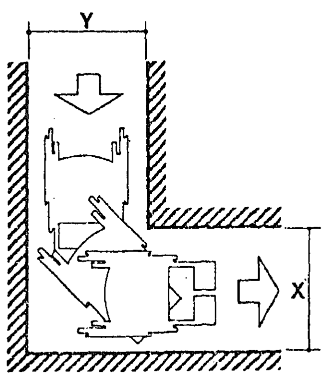
Researcher	X	Y
Walter	180	215
Brattgard[a]	150	150
Nedrebo[b]	150	150
McCullough[c]	162	193

[a]Allowed two 90° turns.

[b]Source: Brattgard, 1974

[c]Not reported as a minimum.

Table 8: Space Requirements for Making a Right-Angle Turn (in centimeters)



Researcher	X	Y
Walter	109	84
Brattgard	100	80
Nedrebo[a]	100	90

that the sequence of tasks will be quite variable (... 1968). Another example is the study of doorway use by wheelchair users. This research has shown that access through doorways is highly dependent on the characteristics of space available in front of the doorway, which in turn depend on direction of access and direction of door swing (Walter, 1971).

Research Methods

In reviewing the research in human factors some important methodological concerns were identified:

1. Use of reactive instrumentation,
2. Overreliance on research in laboratory settings,
3. Selection of subjects for testing in regard to generalizations from small samples, and
4. Within-subject experimental designs.

Instrumentation in human factors experiments is often elaborate and obtrusive to subjects. The reason for this is the praiseworthy desire to obtain the most accurate and objective data possible about human performance. Thus, when energy expenditure is being measured, oxygen consumption and/or pulse count are used as variables. Measurement of these variables requires a mask and back pack and/or sensors attached to the body. Such instrumentation can have a reactive effect on human performance by impeding body movements or imparting an unnatural expectancy associated with an activity. The same may be said for instrumentation that is not attached to the body but that is unfamiliar and "technical" looking to a subject. These instrumentation techniques contribute to what has been described as the "guinea-pig effect" (Webb. et al., 1969, p 13).

The extensive use of laboratory settings for research raises questions about the transfer of recommendations generated in the laboratory to field situations. Although close simulations of field settings are often used, laboratory research reduces the complexity of tasks performed in natural settings. For example, testing of suitable range burner control arrangements in a laboratory would not take into account the surrounding ambient environment in a typical kitchen or the relationship between using range controls and other kitchen tasks. These questions are even more pregnant when research tasks are similar in nature but not in their consequences to the actual tasks (e.g. risks involved, sequential dependencies). For example, testing stair configurations on a ladder treadmill in a laboratory does not account for the risks people take as they walk up a flight of exterior stairs.

Subjects used in human factors experiments are often not identified clearly in reports. Moreover, when they are identified, they often are not truly representative of the user population. Anthropometric data gathered from military populations, for example, cannot be used with reliance for designing kitchens. Large sample sizes are not always required for generalization of research results, if the subjects can be

user population. For example, determining the minimum width of an opening may only require measuring the widest people in the population. However, human factors studies using small samples often fail to report the characteristics of the subjects in sufficient detail to assess potential generalization of findings. Moreover, in studies of disabled people it is difficult to determine how the abilities of a small sample chosen in an expedient way compare to the abilities of other disabled people, since normative data on functional abilities is not available.

Human factors experiments often use a within-subject experimental design. This means that one subject will be tested under several experimental conditions. For example, a table will be adjusted to different heights while the subject repeatedly performs a work task. Poulton has observed that such designs should be regarded as learning experiments: "The people are trained or partly trained, on all the conditions included in the experiment. The results apply only to people trained like this" (Poulton, 1973, p 17). He shows how bias can develop with such designs, by comparing data from experiments in which the range of table heights used as experimental conditions was different but overlapping; the findings showed a different optimal table height for each experiment. For many tasks, the variability of conditions is so great that it would be prohibitive to test each condition with a different set of subjects as Poulton suggests. The method of fitting trials describbed by Jones (1969), which is similar to the procedure used by eye doctors to prescribe glasses, is one way to reduce the effects of learning bias without increasing the costs of testing beyond feasible limits. Fitting trials utilize a range of conditions that is inclusive from one extreme to another, and repeat the testing with each subject from two directions. This is not ideal because it can generate two "optimal" conditions for each subject; however, it is an improvement on existing procedures.

Some changes in research methods that may improve the validity of human factors research findings include the following:

1. Unobtrusive instrumentation,
2. Field testing or more accurate simulations of real-world tasks and environments,
3. Representative selection of subjects, or use of a large subject pool,
4. Detailed descriptions of subjects in relation to the larger population, and
5. Elimination of bias due to within-subject experimental designs.

These methodological concerns raise specific questions when reviewing the conclusions reported here from human factors research done with disabled subjects. There are many discrepancies in the findings on the various topics that have been studied by more than one research investigation. Many of these discrepancies can be explained by differences in the characteristics of samples; for example, the recommendations for ramp design from the two ramp studies were widely different. However,

the difference in the people-- older people (many from institutions) on one hand, and young physically fit college students on the other, explains the differences in recommendations. Generally, Walter's findings tend to be much more tolerant of a higher level of disability than the other studies. Probably because he used a sample that, from the meager descriptions given, appears to be a more disabled group. McCullough and Farnham adjusted counter heights to comfortable working heights but they don't report if they started low or high. In light of Poulton's findings, the application of their results would differ, depending on the procedure.

A difference in testing procedures may be the cause of the differences in findings for maneuvering a wheelchair through a 180 degree turn. For example, Walter and McCullough and Farnham had their subjects complete the maneuver through a confined space; Brattgard had them do it in an open space. Walter required his subjects to complete a continuous turn, while Brattgard allowed two 90 degree turns. McCullough and Farnham do not report what type of turn was required.

When studies are done in several countries, generalizability of findings may be limited. For example, European door sizes are different than American door sizes. Thus, the clear opening of 78 centimeters used by Brattgard could not be obtained with a standard door in the U.S. where the clear openings closest to it would be 76 centimeters (30 inches) or 80 centimeters (32 inches).

Another source of differences in the recommendations may be the treatment of data in terms of inclusiveness. For example, Walter made his recommendations by including all but 5 percent of the sample. That is, if the recommendations were followed in design, 5 percent of the sample would not be able to use the resulting building element. On the other hand, McCullough and Farnham report the range of their results and make recommendations that lie at one point within the range, but they do not report the judgments they used in extracting the recommendations from the results. All these examples indicate that the sources for differences in the reported research with disabled people are quite numerous. Almost everyone of the studies demonstrates one or more of these limitations so that comparing results must be accompanied by a comparison of methods, sample selection and treatment of data. These problems limit the usefulness of available information.

Conclusions

Conceptualizing access as a set of tasks establishes a framework for information needs in design. The concept of task environment enables a review of human factors knowledge with the greatest potential for information transfer to building design. It is evident that existing knowledge in the field of human factors analysis can provide a great many useful principles for design of accessible environments.

The review of available information can be summarized by the following broad conclusions:

1. Functional Anthropometry
   A. The principles of applying anthropometric data to design are well established.
   B. There is a need for better data on disabled populations.
   C. The most useful kinds of data to obtain would be dynamic and situation based.

2. Biomechanics
   A. There is a need for a comprehensive presentation of information on range of movement for disabled people.
   B. Basic principles for considering range of movement and accuracy in design are available.
   C. General principles for considering speed of performance are well established.
   D. There is a need for data on strength in situations that are typical of building use.
   E. There is a need for general data on strength of disabled and elderly populations.
   F. Some data on endurance and comfort is available, yet there is a lack of data for some important design concerns regarding disabled and elderly people.

3. Information Display
   A. Principles of coding and organization of information are well established.
   B. There is a great deal of general design data available, much of which can be applied to disabled and elderly users.
   C. There is a lack of information on tactile warning signals.
   D. Information is needed about the perceptual processes of people with sensory impairments.

4. Specific Task Environments
   A. Research on specific task environments can provide important data on relationships between elements in a setting.
   B. Empirical research on specific environments using disabled subjects is conflicting.
   C. There is a lack of research on bathroom design for disabled people.

5. Research Methods
   A. Research methods in human factors analysis should

of research by proper generalization from sample populations.

On the whole, existing human factors knowledge includes a great deal of design information pertaining to access. There are also some important information gaps.

This review would not be complete without giving some attention to the future. In particular, it is useful to consider how human factors perspectives might be changed to provide information that is more relevant to the concerns of buildings, sites, and building product design, and, in particular, for access.

One existing perspective has been the conception of human behavior in stimulus-response terms. A change in this view toward a concept that encompasses motivation, social interaction, attitudes, beliefs and developmental change, would be appropriate. It is true that contemporary human factors analysis considers mediation processes (McCormick, 1970) that affect task performance. However, analysis has not, due to the stimulus-response perspective, adequately dealt with the effects of the environment on people, and with the motives of human behavior. Parsons (1974) has suggested a bonding between human factors analysis and behavior modification as a means of broadening the human factors viewpoint toward motivation. Other avenues of fruitful development are toward transactional and gestalt conceptions of behavior.

When using a building, people are not only responding to the stimuli received from their senses, but they are proceeding with a set of cultural expectations and understandings of how that building is or should be constructed. Moreover, the motives and patterns of activity are based on social interaction goals as well as organismic needs. The entire field of physical and social forces has a holistic effect on the user's behavior (Ittelson, et al., 1974). Although the stimulus-response conception of behavior may be satisfactory when studying man-machine systems and work stations for military and industrial applications, when extended to the architectural environment of public buildings and private residences, it is less than satisfactory.

Another existing human factors perspective that could be beneficially modified is the focus on efficiency as a goal in human performance. Again, this goal is highly useful in the military or industrial context, but is it so applicable in other contexts? Churchman (1968) suggests that efficiency in system performance is not always synonomous with quality. A design goal of efficiency might lose sight of important human concerns such as privacy or informal social interaction. From a systems analysis view, efficiency in one system component may detract from efficiency of the whole system. A job schedule without allowances for a coffee break is an example of efficiency misdirected. The value of the efficiency perspective in human factors work should not be overlooked. It provides a reality base and general measure of performance which increases its value to those who pay for research and application.

ever, new perspectives should be developed that focus on specific often multiple objectives of whole systems. The need for efficiency performance within a multiplicity of objectives can then be assessed. example, one layout of kitchen work centers may be more efficient in ms of food preparation than another. But other activities take place kitchens that may be excluded by the first arrangement. A systems roach seeks to optimize the entire system for multiple objectives, ch may often require suboptimization of different components.

nges in the perspectives as outlined above would create a new stage the evolution of human factors research-- a stage that viewed the human only as a producer or controller, but also as a consumer. Such a w would be most appropriate for research on task environments for ess.

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7
mpact of Inaccessibility

Introduction

The study of accessibility for people who are disabled has focused on barriers to movement and to use of buildings, equipment and landscape. Certainly barriers deter people from pursuing certain activities, but action is not the only facet of behavior. There are many psychological and social implications of inaccessibility. This section explores contemporary knowledge of the relationship between human behavior and physical environment to identify those implications. Specifically it is concerned with how barriers affect the development of maximum human potential.

Before reviewing knowledge areas, it will be useful to present a model of how people relate to the physical world. The scientific study of behavior and environment is fairly new and there is not yet an accepted paradigm for this relationship. Generally, models that have been proposed are based on theoretical orientations from the behavioral sciences, particularly psychology (Ittelson, et.al., 1974). The model proposed here is based on the work of George Herbert Mead and Kurt Lewin (Mead, 1934; Lewin, 1936).

Mead's theoretical orientation proposes that a person develop a "self" (self-image) through his or her transactions with other people. A person's sense of self is determined by what he or she does and by the reflections of those actions as transmitted in the responses of others. Thus, a person may do things that are considered deviant by others who, in turn, will "tell" the doer that he or she is deviant by treating them as such, e.g. shaming, punishing, etc. The result is that the person develops a sense of self as deviant from others. A person constantly validates their self through transactions with others and subsequent adjustments to certain commonly held beliefs or norms about how people should relate to one another in a culture or other social system.

Lewin's Field Theory proposes that human behavior is based on the "continuing interaction of factors within the person...with other external factors as they are perceived in a given situation" (Ittelson, 1974). His concept of "life space" proposes that the environment, which may be social or physical, provides positive or negative forces to influence behavior. The effect of the life space depends to a great extent on how this space is perceived and the state of individual factors at a particular time. Lewin's theory developed out of gestalt psychology, which has as its central focus the concept that perception of the world is based on its total *gestalt*, or form as experienced, either consciously or unconsciously, by the individual. People with different experiences may perceive the same object, activity or other person's actions differently. Depending on an individual's needs, feelings, values and predispositions, the effect of the life space as a field of forces may be different at one time than at another. The field of forces always influences people as a *gestalt* rather than as individual forces.

reflected through the design and management of physical elements in the life space, as well as through social actions. Design, space management, social organization and social interaction are each ways in which individuals and groups tell how they value others and how they value themselves. As proposed in gestalt theory, the perception of these transactions may be different for each individual, depending on their previous experience. For example, a person raised in a culture with no written language would not experience a sign which stated "no unauthorized persons permitted beyond this point; violators will be shot on sight" as an important "force" in his or her life space. On the other hand, an individual with the required authorization would not either; however, someone who had lost the authorization would.

The theories discussed above deserve more detailed attention as does the model of environment-behavior relationships we ourselves have proposed. But this is not the main purpose of this paper. Interested readers are referred to the references for further information.

One other assumption guides the following review. A person with a disability may be very competent and talented in all attributes of behavior other than that dictated by the disability. Clearly, there will be a broad spectrum of abilities among disabled people. However, an environment that is designed in such a way as to preclude use by a person only because of a disability does not allow that person to pursue life to the fullest potential. This is one common and current way in which society views each disabled person as a personification of disability. Their abilities are ignored. Our view is that each person should be viewed as a normal person and is thus entitled to normal use of the environment. Design, then, should insure that a disability is not a handicap in the development of one's abilities. Normal use should not be conceived as normal in the descriptive sense. Obviously, a person in a wheelchair will look different than a person walking when moving from point A to point B. We propose that normal use be perceived from the point of view of personal competence. If the environment allows all people to use it normally, it means that all people will have a normal chance to be competent in it.

The remainder of this paper reviews several relevant knowledge areas of environmental behavior to identify the psychosocial effects of inaccessible environments. The knowledge areas are:

A. Environment as language,
B. Environmental cognition,
C. Territoriality,
D. Exploration and the development of competence,
E. Adaptation careers.

Some of the implications have a strong basis in empirical research. Others are based on theoretical perspectives and empirical research in other than environmental concerns. It is hoped that the identification of validated and hypothetical implications will help to create an understanding

benefit analyses. It is hoped that designers, planners and policy make will also reflect on what they are "telling" some users of the places they control, when they allow barriers to access to be built.

Environment as Language

How does the physical environment communicate to people? The study of proxemics (the use of space in face-to-face social interaction) has de onstrated how the physical structure of the environment provides "sets for certain types of behavior. For example, activities normally considered as private do not take place unless conditions are acceptable for private activity.

Osmond and Sommer have identified spatial characteristics that encoura or discourage social interaction (Sommer, 1969). Hall has identified interaction sets for different types of social interaction (Hall, 1959 These physical conditions are based on physiological characteristics, e.g. the maximum distance at which facial expressions cannot be perceived, and on culturally held assumptions of appropriateness, e.g. wh a person is allowed to touch another. They are modified by participan characteristics such as sex, age and stigma of the interacting individuals.

Through cross cultural studies, it has become apparent that cultures shape their physical environments according to culturally held attitud about the uses of space (Hall, 1969; Rapoport, 1969). Environments shaped by people, then, tell an observer something about how a place should be used since spatial characteristics are associated with space use. For example, monumental stairs tell us that we should have a sense of awe and respect for that which is above. Stairs have been used traditionally to set one individual above another. The meaning of building form, however, is perceived through a cultural screen, since different cultures have different attitudes about the use of spa

Objects can have a social meaning. Clarke, basing her thinking on studies of language, proposes that socioeconomic classes have differences in the vocabularly they use to describe the physical environment (Clarke, 1974).

Studies comparing architect's descriptions of spaces and buildings wit those of nonarchitects have shown that different reference groups describe the same environment differently (Hershberger, 1970). This backs up Clarke's thesis and lends weight to her untested proposition that social groups code the environment differently; that is, their relationship to it is structured in different ways.

Clearly, the physical environment does send messages to people who use it and people "read" these messages in different languages.

People with disabilities may use different dialects in reading message from the environment. DeLong has demonstrated that a physiological

ing of proxemic sets (DeLong, 1970). He demonstrates how elderly people who share sensory disabilities use physically different social sets than young people of the same culture. They must be closer and have tactile contact in order to maintain communication with another person.

DeLong also demonstrates how incongruence between two different social interaction sets leads to misunderstanding and affective reaction. As noted in his research, doctors who maintain very close interaction distances, which are commonly thought of as intimate, put on a cold technical manner in order to examine patients without getting "intimate" or emotionally involved. The older people associated this set with less intimate social interaction. They felt the doctors were, therefore, being unfriendly and treating them as inanimate objects.

Such incongruence in meaning may also exist in interpreting the physical world. For example, a person confined to a wheelchair cannot negotiate monumental stairs. Rather than having a sense of awe and respect, such a person is likely to feel angry at that which is above. If the culturally held meaning of whatever is at the top of the stairs is good (e.g. place of worship), the person may also feel that they themselves are bad as a reflection of the denial of access to goodness.

Environmental language that does not treat all people as spatially normal renders them illiterate. Thus, blind persons who cannot find enough auditory and tactile cues to interpret what is around them, may find themselves acting in inappropriate ways for the setting. This in turn, leads to social reactions that reflect the deviance back to the actors. From another perspective, environmental language that creates misinterpretations or other forms of incongruence between cultural attitudes and personal experiences may cause negative feelings of self-worth.

Environmental Cognition

Piaget has investigated the development of spatial cognition in childhood (Piaget and Inhelder, 1966). As children progress through infancy, preschool period, middle childhood and adolescence, they organize space first from an egocentric orientation and then develop coordinated systems of reference based on fixed objects. Piaget has enumerated levels of spatial intelligence: sensorimotor, intuitive, concrete, operational and formal operational. It appears that spatial cognition is neither only accumulative or only innate; it stems from a complex system of cognitive ordering (Hart and Moore, 1973).

The process of ordering space has been called cognitive mapping. It is defined as a coping mechanism through which the individual answers two basic questions quickly and efficiently:

> Where certain valued things are; and how to get where they are from where one is.

Cognitive mapping is a function of space negotiation abilities, sensory

reception abilities, storage capacity and time spent in an environment.

How can we account for the fact that different groups appear to have different cognitions of the world? In our everyday environment there are an infinitely greater number of discrete objects or parts of discrete objects than can be identified. We can only notice a small number of these objects; we do choose to notice things which have special usefullness and meaning to us. For example, people with different disabilities select different objects in the environment to use as place markers. Since the meaning of objects, therefore, is created through interaction with one's fellows--and since people form discrete interaction groups with different purposes, values and ways of interacting with objects--it is only natural that people should cognize the world differently. People with certain disabilities, therefore, may have different cognitive maps than do people with other disabilities or the nondisabled. They have these different maps for the simple reason that they use the environment differently.

It is likely that a person, to whom the community is relatively inaccessible, will have a cognitive map with much less detail and accuracy than a person to whom the community is accessible. A cognitive map is basically a representation of what a person knows about a place. An accessible physical environment allows people to develop detailed and accurate images of the community. Without such images, one cannot use the community effectively.

Territoriality

Territory is the "area which is first rendered distinctive by its owner in a particular way, and secondly, is defended by the owner" (Sommer, 1969). Not only does each individual and/or group perceive and map space, but individuals and groups also attach rights of ownership to spaces they use. Territorial instincts are so strong that sanctions against spatial invasions of territory are often backed up by law.

The study of territoriality began with animals and has extended to human use of space (Lyman, Stanford and Scott, 1967). Humans have a greater scope of territorial behavior than animals. Their territorial ownership extends from geographic space to people, objects and ideas. As animals mark by defecation and urination, people use nameplates, fences, walls, etc. as environmental props to mark their territory. Defense of space by humans is seldom characterized by full-scale aggression as it is in animals.

Both in animals (Hall, 1969) and humans (Esser, et al., 1965) it has been demonstrated that the possession of territory is intimately related to hierarchies of social dominance: the most powerful individuals obtain and maintain the best territories.

For people who are disabled, barriers to access are territorial markers, just as surely as trespass signs. It is evident that exclusion from

less explicit is the behavioral implication of exclusion. The fact that the able-bodied population has full use of public places means that they have a socially dominant position in respect to those with disabilities. By building inaccessible buildings and transportation systems, they have effectively claimed territorial possession of them. Perhaps the most humiliating aspect of territorial dominance has been the building of special environments, primarily institutional, for those that do not pass the test for entry into the able-bodied world.

Exploration and the Development of Competence

White (1970) argues that environmental competence is achieved through exploratory behavior. He proposes that as children explore the environment they manipulate it; and the skill that they develop through manipulating is what we call environmental competence. He argues that at any given time an individual has adapted to a certain level of environmental competence, and that in order to avoid boredom one must constantly explore the edges of this competence. Individuals are constantly seeking a mild state of disequilibrium in order to extend their mastery. If there is too great a discrepancy between one's competence and one's attempts to deal with the environment, then one becomes frustrated. What one seeks is a slow, continuous adaptation to his environment. As White states:

> "Dealing with the environment means carrying on a continuing transaction which gradually changes one's relation to the environment" (1970, p 132).

A very great amount of one's environmental competence is learned as a child; however, an individual goes on exploring continuously and hence this relationship to the environment is continually evolving.

Let us now consider exploration and the development of environmental competence among disabled people. Disabled persons, for the most part, find that there is a huge gap between their level of environmental competence and that which is necessary to deal effectively with the environment. As White (1970) indicates, when there is too much of a gap, exploration is discouraged. Since the disabled person is frustrated in their efforts to explore, there is little chance that they will be able to undergo the adaptation process that nondisabled people undergo continually. This does not mean that they will experience no adaptation, but that the level will be so low that change in mastery will be minimal. The disabled person, therefore, does not develop an acceptable level of competence in regard to the environment. The gap between existing competence and the demands of the environment will be directly related to a person's dependency on others to meet the needs of everyday life or to a person's unfulfilled needs.

A failure to develop environmental competence has strong consequences for the self. The self or identity is not something that is static; rather it is something that one must continually act out and reaffirm both to

oneself and to others (Mead, 1934, Strauss, 1969). Put simply, the self is created and sustained through action. The type of action, therefore, determines what kind of a self one is to be. The disabled person who is unable to develop environmental competence and is dependent on others is regarded by others to have an incompetent self. A person with a disability often finds that their personal identity (the fact that he/she, John or Joan Doe, who lives on such and such a street, is twenty-nine years old, has blond hair and blue eyes and is bad-tempered when he/she wakes up) tends to be overshadowed by his/her social identity (the fact of disability). In the eyes of the nondisabled, the personal and competent aspects of his or her self are, therefore, submerged by the social and incompetent aspects of the self. Since, as Mead (1934) points out, we count on others to confirm our identity, the disabled person may share the view of the incompetence ascribed to them by the nondisabled or at least will have to deal with it. Often a person with a disability must work especially hard to assert their competence against the prejudice of others' perceptions.

This overcompensation is not required of those without disabilities. Those who cannot overcompensate in some way must accept other people's perceptions as valid. A self-conception of incompetence discourages the disabled person from exploring the environment and, therefore, gaining competence. This process creates a vicious circle: inability to develop environmental competence leads to self-conception as incompetent which in turn discourages the exploration needed to develop competence. Even those who overcompensate in some way must face this issue in public among strangers who do not know of the competent aspects of their self.

Adaptation Careers

The question arises, how does one escape from this circle? The answer may lie in the notion of adaptation careers. Ordinarily, the term career refers exclusively to a person's passage through an institution, or more specifically, it refers to a person's working life. Glaser (1965) and Strauss (1968) and Goffman (1961) (1963) have expanded the notion of career. They use it as an analytical tool to describe the shared movement of individuals through a variety of diverse social contexts. This allows them to compare such seemingly different phenomena as the careers of academics, patients dying of cancer in hospitals, and husbands and wives as their marriage evolves. Examining these things as careers has the advantage of revealing the underlying temporal regularity of any given individual's status passage. Each type of career has a timetable, which dictates the normal time for passage, and bench marks along the way to inform the person who is passing, and others, how they are faring. This regularized temporal passage which constitutes the normal career is widely recognized by society. Hence, we find doctors expressing surprise that a given patient is recuperating sooner than expected or conversely dying faster. Similarly, we find exceptionally successful young people being defined as precocious because they are ahead of the normal timetable. These careers which are by definition shared with others become institutionalized; hence, the participants develop a shared perspective. They assess things in terms of their

career and more particularly in terms of the particular stage of the career in which they find themselves at any given time.

The kinds of careers in which we are especially interested are those of disabled persons. For any given disability there exist a number of separate careers that overlap and effect the ability of the affected person to achieve varying degrees of environmental competence.

The first career is that of the physiological disability. One can describe the progression of any given disease from its inception to its termination, should it be allowed to run its course. Often the career of the disease is aborted and the individual embarks on the career of a person who is well, or is left stranded in midcareer with the effects of the disease neither advancing or retreating.

The second career is what we shall term the individual's adaptation career. Physical therapists and others try to provide patients with skills to deal with their disabilities. This can be viewed as a career in that there are certain standard ways in which people with certain types of disabilities are taught to deal with them. There is also a normal timetable for acquiring these skills. Just as an individual may or may not have a successful business career so he may or may not have a successful adaptation career.

The third career that is relevant to this inquiry and crosscuts the other two is age. Clearly, one's life can be seen as a career. This impacts on the other two in that at certain times within the life cycle one is more likely to have certain diseases. Similarly, at certain times in the life cycle (notably old age) it becomes much more difficult to have a successful adaptation career.

The fourth and final career is that of the environment's response to the individual. There are certain limits to the extent to which an individual can adapt; these limits are physiologically set. The environment, on the other hand, can be changed in an infinite number of ways and hence, is potentially much more adaptable than the human body (Lawton and Nahemow, 1973). By manipulating the environment we can achieve a much higher level of success in the adaptation career of the disabled (Lawton and Nahemow, 1973) (Perrin, 1970). The environment, then, must be constructed in such a way that it can easily accommodate the changing needs of disabled people as they move through their disability careers. Although "flexible" is a term often used to describe such environments, the key variable is actually responsiveness. An environment need not be flexible to be experienced differently. The adaptation career of a building, therefore, consists of changes in the way it can be used. Thus, instead of simply having life cycle careers (environments get old and fall apart), buildings ought to have adaptation careers which are congruent with the adaptation career of disabled people. Such environments can be built once we know what a successful

crosscuts some of the careers that we have just described. Style of adaptation might be thought of as analagous to the type of professional career that a person chooses. Certain people are, or at least feel that they are, more suited to certain types of work than others. Similarly, some types of people are more likely to respond successfully to one type of adaptation career than to another. Lowenthal and Chiriboga (1973, p 302) state that different adaptation styles are suitable at different times in the life cycle, as there is interlocking of the person's adaptation career with his life cycle career. Lowenthal and Chiriboga (1973) go on to make the point that there are a variety of possible adaptation styles and that the significant choice factor is stress. One should choose the style which causes the least stress, in a negative sense. This, as they point out, is a function of a person's reference group which of course is intimately linked to their image of their former self (Lowenthal and Chiriboga, 1973, p 287). If there are a variety of adaptation styles that are efficacious, are there also a variety of environmental contexts in which this adaptation can take place?

To foster exploration and the development of competence, an environment must be explorable and manipulable by a disabled person to such an extent that it encourages further exploration. The environment must present a challenge but not frustrate the disabled person's attempts to develop skill at manipulation. The process of developing a competent self has similarities with the process of developing an incompetent self, mentioned earlier. Just as failure reinforces incompetence, success reinforces competence. The ideal environment for any person ought to be responsive enough so that a progressive spiraling of achievement can take place. One success leads to confidence, which leads to further exploration and manipulation, hence, the acquisition of skills and the positive self-image of one as competent. This is further reinforced by others whose image of the disabled person changes as they see visible signs of increased environmental competence. At least, the environment should allow maintenance of competence levels already reached.

Conclusion

The built environment communicates to those who use it. It speaks a kind of "silent language" (Hall, 1959) that transmits messages about appropriate behavior and meanings. These messages also can have an affective component that reflects back to the user. Individuals who because of disabilities are illiterate in the language of environment, or who interpret messages through a physiological screen, may not receive important information or may interpret messages differently than the nondisabled. Illiteracy and interpretation problems can result in inappropriate behavior, confusion or negative feelings of self-worth.

The way one organizes space as a mental image is based on how one experiences it. Although further research is needed in environmental cognition, it appears that people with disabilities may image space differently than able bodied people, since they have different kinds of experiences. Differences in experience lead to differences in value

n parts of the environment and in systems of orientation. Lack of bility to experience the environment results in poor cognition of it, hich in turn, hampers one's efforts to use the community.

erritorial behavior is closely associated with social dominance. Exlusion through environmental barriers can be viewed as a form of teritorial behavior whereby the able bodied claim the best space. The isabled act out their lowly position in the dominance hierarchy by ccupying stigmatized, and often, institutional space.

he development of competence-building settings can improve the adaptive apacity of disabled people. The relationship between these two may be iewed as a set of interlocking careers; the adaptation career of the inividual and the adaptation career of the environment. If the environment s responsive enough to meet the needs of a person, then one creates pportunities for increased competence, and the resulting greater adapation to the circumstances of a disability. Environments must be deigned so that they can respond to the physiological and adaptation areers of the individual.

lthough we have identified several discrete psychosocial implications f inaccessibility, they do not act independently to effect a person's ehavior; the entire social and physical world impacts on a person. ndividual forces in the life space cannot be added together as simple ums, rather, they work as a whole and as a function of the individual s well. For example, all disabled people probably do not experience the egative effects of territorial exclusion as social dominance. Moreover, ttitudes and action of other people that send positive messages to the isabled person may counteract negative messages from an inaccessible uilding.

t is important to remember that a society may act supportively in many ays through interpersonal actions of its members but social actions in haping the physical environment may be unsupportive--not because of their ttitudes, but because of traditional ways of building, and lack of alterative responses. If our society should change its attitudes toward disbled people, without corresponding changes in the built environment, a ruly responsive life space will not exist.

utlook for the Future

he task which faces us is to design truly responsive environments where ll people have opportunities to develop competence. As we have seen, ne cannot speak of competence as being a quality which lies exclusively ithin individuals. Rather, it is a relationship between oneself and he object that one is attempting to manipulate. Environments are contructed to fit average physiological norms, to allow the average person o display an average amount of environmental competence; moreover, few nvironments are designed to respond to disability careers. If the deign of the environment gets out of line with the physiological norms f people, then the people, of course, become less competent. The term

"nonfunctional", i.e. one cannot function (be competent) within it. When such a condition exists, the blame for the misfit is placed upon the environment and it is subsequently changed. Since the disabled person has different physiological norms, it is only natural that his relationship to the environment is different from that of the able bodied person. He can no more be expected to adapt and develop competence in a misfit environment than can the able bodied person. However, when such a misfit occurs for the disabled person, the blame is placed on the person rather than on the environment.

This shifting of blame from the environment to the person is an ideological position based on the value assigned to disabled people. Once this position is changed so that the environment is blamed, then responsive environments can be created in which disabled people can display competence and, by extension, overcome much of the dependency and stigma which stems from being environmentally incompetent.

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Changing Attitudes Through Design

8

Introduction

There is a "stigma" associated with disabilities which affects the quality of social interaction between people with disabilities and able-bodied people, and hence the overall quality of their lives. Much of this stigma stems from a lack of competence in dealing with the physical environment. Creating a barrier-free environment may reduce stigma by increasing competence. To determine how, we must examine the relationship between stigma and environment.

To the Greeks who originated the term, stigma referred to "... bodily signs designated to expose something unusual and bad about the moral status of the signifier. The signs were cut or burned into the body and advertised that the bearer was ... a blemished person, ritually polluted, to be avoided, especially in public places" (Goffman, 1963, p 11). Goffman goes on to tell us: "Today the term is widely used in something like the original literal sense, but is applied more to the disgrace itself than to the bodily evidence of it" (Goffman, 1963, p 11). Stigmatizing attitudes exist in varying degrees and forms in our society. They serve to lower the quality of life for the handicapped person by closing off accessibility to valued activities. This stigma is not apparently inherent in the handicap itself, but rather appears to be the outcome of a set of social relations and interactions between the handicapped person and the nonhandicapped person.

A handicap in itself may be viewed positively or negatively, according to the cultural set. For example, the footbinding of aristocratic women in China was a disability that was viewed as enhancing status. In fact, it was stigmatizing not to have such a disability (Wright, 1960, p 9). If we are able to modify the quality of the interaction between the handicapped and the nonhandicapped, then it follows that we should be able to modify the stigma which is the product of that particular interaction.

Submerged Identities

The main problem faced by handicapped persons in social interaction is that in the eyes of the able-bodied their identity is totally consumed by or submerged in their handicap (Wright, 1960, p 8-127).

> "If I had to choose one group of experiences that finally convinced me of the importance of this problem (of self-image) and that I had to fight my own battles of identification, it would be the incidents that made me realize with my heart that cripples could be identified with characteristics other than their physical handicap. I managed to see that cripples could be comely, charming, ugly, lovely, stupid, brilliant -- just like all other

groups (such as criminals), who are not granted the components of a normal or socially accepted identity. Since these components constitute, in the layman's mind, those things which make a person human, it becomes understandable that the person with a stigmatized identity -- who is not thought to possess these components of identity to the same degree as the normal person -- should be considered something less than human.

An illustration of this kind of dehumanization is provided by a professional criminal.

> "You know, it's really amazing you should read books like this, I'm staggered I am. I should've thought you'd read paper-backed thrillers, things with lurid covers, books like that. And here you are with Claud Cockburn, Hugh Klare, Simone de Beauvoir, and Lawrence Durrell.
> You know, he didn't see this as an insulting remark at all: in fact, I think he thought he was being honest in telling me how mistaken he was. And thats exactly the sort of patronizing remark you get from straight people if you're a criminal. 'Fancy that!', they say, 'In some ways you're just like a human being." (Parker and Allerton, 1962, p 111)

The problem of having one's identity submerged in one's disability is intensified by what we shall term the gestalt of disability. This is the tendency of the able-bodied person to perceive a given disability as including other disabilities which the disabled person might not possess.

> "... the perceived failure to see may be generalized into a gestalt of disability, so that the individual shouts at the blind as if they were deaf or attempting to lift them as if they were crippled." (Gowan, 1957, p 198)

This of course has serious consequences for the disabled person, for his incompetence in the area of his actual disability is generalized into a general incompetence in all areas.

> "For example, a person with cerebral palsy may not only be seen as burdensome in face-to-face communication, but may also induce the feeling that he is questionable as a solitary task performer." (Goffman, 1963, p 67)

This sterotyping of disabled people as individuals who are totally incompetent is particularly damaging because it is used as a guide to what constitutes proper interaction between disabled and nondisabled people. The fact that there is a stereotyped image of people with disabilities is documented in Wright (1960, pp 119-120). Here college students derived a cluster of personal attributes about people from merely being told that they were disabled. We find that there is

that society assigned to them, for if they do not, others do not know how to treat them.

> "I also learned that the cripple must be careful not to act differently from what people expect him to do. Above all they expect the cripple to be crippled; to be disabled and helpless: to be inferior to themselves, and they will become suspicious and insecure if the cripple falls short of these expectations. It is rather strange, but the cripple has to play the part of the cripple, just as many women have to be what men expect them to be, just women; and the Negroes often have to act like clowns in front of the 'superior' white race, so that the white man shall not be frightened by his black brother.
> I once knew a dwarf who was a very pathetic example of this, indeed. She was very small, about four feet tall, and she was extremely well educated. In front of people, however, she was very careful not to be anything other than 'the dwarf', and she played the part of the fool with the same mocking laughter and the same quick, funny movements that have been the characteristics of fools ever since the royal courts of the Middle Ages. Only when she was among friends, she could throw away her cap and bells and dare to be the woman she really was: intelligent, sad and very lonely." (Carling, 1962, pp 54-55)

Another problem faced by disabled people is that action which would be viewed as normal in the nondisabled is often interpreted as a manifestation of their disability (Wright, 1960, pp 17-126).

Similarly it is felt by many that disabled people should act out their identity as people who have suffered a great loss. Wright (1960, p 242) refers to this as an attitude of mourning. No doubt it is felt that they should mourn the death of their unstigmatized self. This is illustrated by the following quote.

> "People seemed to be a little shocked to hear about it. I had spent an afternoon dancing at the Savoy Plaza. They couldn't explain why they had the feeling, and my announcement that I had enjoyed it hugely and intended to do it again at the first opportunity seemed to make matters worse. It was all just something a blind man shouldn't be up to... it had the general flavor of not properly observing one's period of mourning." (Chevigny, 1962, p 130)

Shifting Focus

In order to decrease what Davis (1964) terms the tendency for others to focus on the handicapped person's disability, the quality of interaction must be changed so that the part of a person's identity labelled

"handicap" decreases in importance and the other elements increase. This is of course done by certain exceptionally gifted people who, because of their brilliance, transcend their stigmatized identity to a large degree. It is not with the brilliant and the extraordinary that we are concerned here, however, for they represent a tiny fraction of those who share their handicap. We must search for methods which can institutionalize a shift of focus for large numbers of handicapped people. This shift of focus can be accomplished in a variety of ways. One is by sanitizing the language about the group. This means is based on the assumption that there is an important link between the way people talk about a thing and the way they think about it. Both are felt to represent the symbolic circles that people draw around categories (Strauss, 1969). With this in mind, representatives of people with various disabilities issued a statement that in the future their constituents were no longer to be referred to as "the disabled", but rather as "disabled people". The obvious implication of this was that while the focus was still on the disability some recognition was needed that the group did not represent some abstract subhuman category but were people as well.

Another way of shifting focus away from the disability is by manipulating the environment in which the stigmatized and the nonstigmatized interact. This can be done by increasing the environmental and hence the interactional competence of the disabled person.

> "For example, at a business meeting a participant in a wheelchair is certainly seen to be in a wheelchair, but around the conference table his failing can become relatively easy to disattend." (Goffman, 1963, p 66)

Through environmental modification, the person could be made competent in other settings as well. Much of the stigma that is attached to disabled persons stems from the fact that they do not possess the ability to be self sufficient in a society which values self sufficiency as a cardinal virtue (C.B. MacPherson, 1962). To be lacking in this quality is to be lacking in what is regarded as one of the fundamental qualities of adult humans. As Dexter (1964) has demonstrated in a slightly different context, to be incompetent in our society is to be an object of pity and disdain.

Environmental Competence

Most disabled people are perfectly able to carry on normal activites, including social interaction with able-bodied people; their incompetence only comes into play when they have to deal with the built environment. Unfortunately, environments are constructed, in our society, primarily to facilitate activities of able-bodied people; in order to pursue normal activities and interact normally with others in such environments, certain physical abilities are needed. Therefore, the everyday environment is constructed in such a way that it discredits the performance of people who do not have such abilities. They can no more be self sufficient

use. Given then that environmental competence is a function of environmental design, it becomes very clear that the issue is a political one. A group with very little political weight, in this case disabled people, have had very little say in how the environment is constructed and have paid the price for their lack of input by being unable to negotiate the environment completely. This incompetence is translated into stigma.

Segregation

One of the ways that Western society has traditionally dealt with stigma is through segregation. The process of segregation should be distinguished from the provision of supportive services needed for the severely disabled which have to be provided in a specialized setting, although examples of both segregation and supportive services are often found together. The cause of this segregation can be understood if we realize that an identity is socially maintained. Stigma can be transferred from a stigmatized person who uses a setting to the setting itself and, by extension, to other users of a setting. Even when the stigma does not get transferred to the others in the setting, it can still spread to the setting itself and hence spoil it, from the point of view of the unstigmatized.

> "But people not only expect you to play your part; they also expect you to know your place. I remember for instance a man at an open-air restaurant in Oslo. He was much disabled and he had left his wheelchair to ascend a rather steep staircase up to the terrace where the tables were. Because he could not use his legs, he had to crawl on his knees, and as he began to ascend the stairs in this unconventional way, the waiters rushed to meet him, not to help, but to tell him that they could not serve a man like him at their restaurant, as people visited it to enjoy themselves and have a good time, not to be depressed by the sight of cripples." (Carling, 1962, p 56)

The following quotation points out a number of interesting features in the segregation of the disabled. First, it points out the pressure toward maintaining a segregated world rather than preparing the disabled person to adapt to the "outside". Second, it illustrates the demeaning nature of much of the activity that goes on in these settings, and how this cannot help but affect a disabled person's self-concept. Third, it illustrates how a person who has recently acquired a disability, and has, therefore, not yet acquired a stigmatized self, reacts to such segregation.

> "My questions about a guide dog were politely turned aside. Another sighted worker took me in tow to show me around. We visited the braille library, the classrooms, the clubrooms where the blind members of the

> where on festive occassion the blind dance with the blind, the bowling alleys where the blind play together, the cafeteria, where all the blind gather to eat together, the huge workshops where the blind earn a subsistence income by making mops and brooms, weaving rugs, caning chairs. As we moved from room to room, I could hear the shuffling of feet, the muted voices, the tap-tap-tapping of canes. Here was the safe, segregated world of the sightless -- a completely different world, I was assured by the social worker, from the one I had just left...
> I was expected to join this world. To give up my profession and to earn my living making mops. The Lighthouse would be happy to teach me how to make mops. I was to spend the rest of my life making mops with other blind people, eating with other blind people, dancing with other blind people. I became nauseated with fear, as the picture grew in my mind. Never had I come upon such destructive segregation."
> (Keitten, 1962, pp 37-38)

It should come as no surprise that such segregation exists, since the world is organized primarily by able-bodied people, and their convenience and gratification tends to be the highest priority. It is also convenient for the able to segregate the disabled because less resources and attention have to be devoted to their problems. Segregation eliminates for the able the social discomfort of face-to-face interaction. Such segregation is often rationalized as the best way to provide supportive services. However, there is no inherent reason why supportive services must be provided in segregated settings.

Conclusion

Fortunately, environments do not have to be designed for the exclusive use of any one group. For a relatively low cost, existing environments can be modified to allow people with disabilities to use them competently. The cost of designing new environments that will take into account the perspective of the handicapped is even less. Environmental modification should not, of course, be looked upon as a panacea to stigma. It will not eliminate the stigma of disability. It will, however, decrease stigma to the degree that it increases the person's environmental competance. One cannot simply legislate away stigma, because such stigma arises out of interaction between people. We can, however, legislate the design of the physical environment and, by changing the conditions under which people interact, we can eventually change the very quality of that interaction. Hopefully, this will bring closer the day when a person with a crutch is no longer considered first and foremost a "cripple", but someone who is essentially a human being with all of the good and bad qualities that make up that identity.

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